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ABSTRACT

The three units of study presented are designed to promote space-related learning opportunities for gifted students and were prepared by recipients of the Scobee curriculum awards. In "Galactic Colonization for Our Future Astronauts" (Jacqueline Shimonauff), elementary-level students simulate a space experience in which a ship carries materials into high earth orbit to be used in building a space station-travel ship. The travel ship carries people to a planet in another galaxy, and on the planet, three colonies are developed. The students learn about spaceship design and staffing and establishment of various systems (government, economics, education, transportation, and communication) in the new colonies. "Flying High: A Space Science Curriculum Unit" (Paul Robinson) simulates for secondary students the experience of selecting, designing, building, and launching an experiment on the space shuttle. "Search for Truth" (Jane Schaffer), for middle grades and secondary students, stresses the value and meaning of searching and exploring self, others, and the world through literature. Each unit of study includes a bibliography. (JDD)

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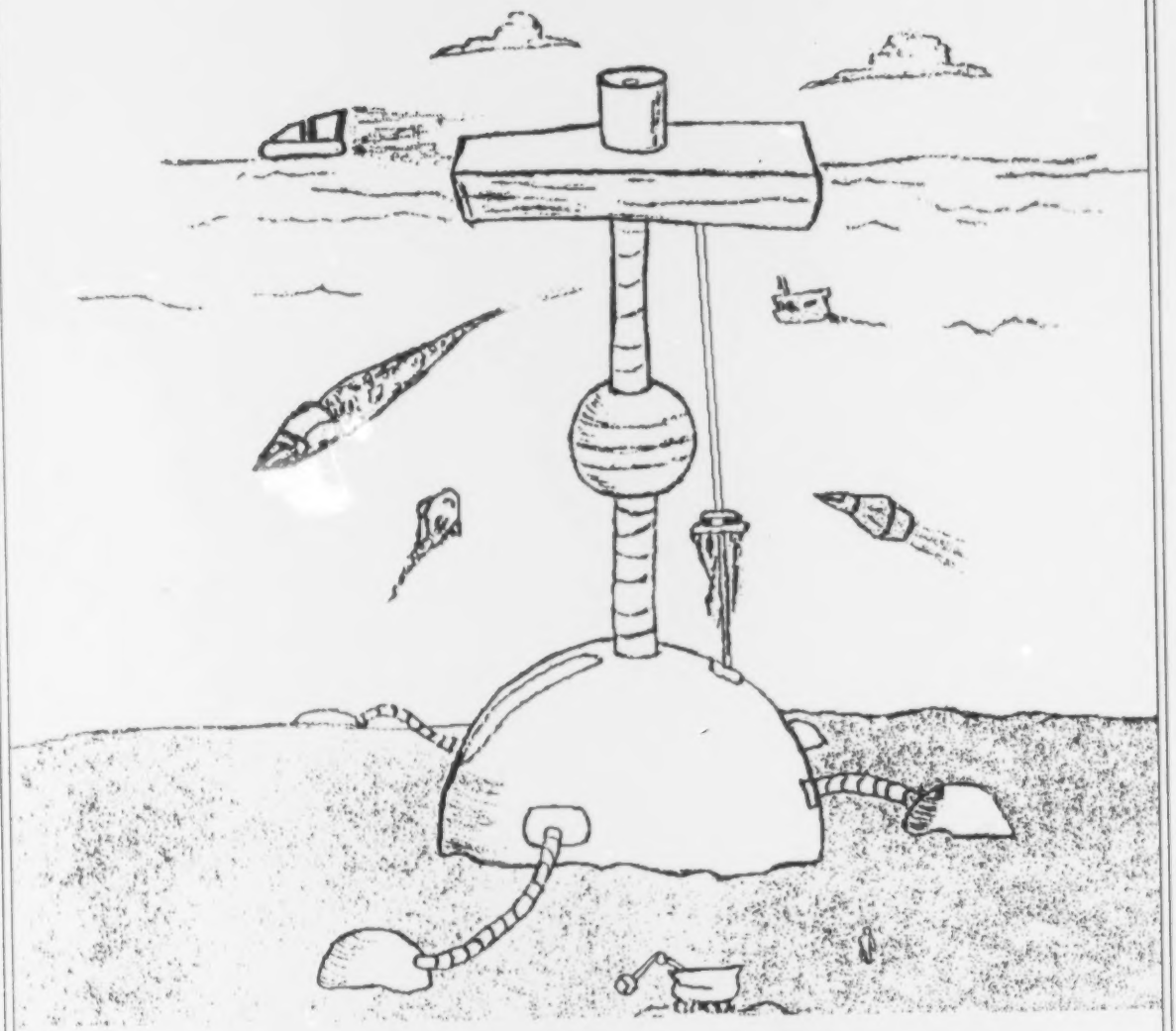
SCOBEE



Curricular Units

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In memory of

Dick Scobee
Commander of the Challenger

With respect for his love of space
and concern for the education
of gifted students.

1989
California Association for the Gifted • 23684 Schoenborn Street • Canoga Park, CA 91304

Scobee Curricular Units: A Focus on Studies of Space

Sponsored by
California Association for the Gifted

Authored by
Paul Robinson
Jane Schaffer
Jacqueline Shimonauff

Introduction

The Scobee curriculum awards were initiated to honor Dick Scobee, Commander of the Challenger, and to promote space-related learning opportunities for gifted students. A statewide competition was conducted and four Scobee curriculum recipients were named to develop space study units. The following units of study were supported by these awards and have been prepared for dissemination in anticipation that they will provide a curricular framework and/or reference for the teaching of space to gifted students. Proceeds from the sale of this booklet will be used to defray the costs of curricular development grants.

It should be noted that these units of study can be used as written or they can be modified to meet the needs, interests, and abilities of teachers and students. In some instances, the units of study can augment a science program or the unit of study can become a separate and distinct science program. In other situations, the units of study can be used to extend or enrich a facet of a science program one or several students are interested in pursuing.

On behalf of the California Association for the Gifted, we hope these materials will be useful as you create science experiences for gifted students.

Sandra Kaplan, Chair
Special Projects Committee
Marge Hoctor
Ron Fontaine
Linda Loftus
Cynthia Myers
Judith Roseberry

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Units of Study	*Authors*	*Pages*
Galactic Colonization For Our Future Astronauts (elementary)	*Jacqueline Shimonauff*	pp. 1-32

While not strictly a unit of study, the material presented was the product of a class called Thinkers' Paradise. Originally printed as a 78-page book, it has been compressed by reducing the size of original art work and omitting a few pieces which did not reproduce well.

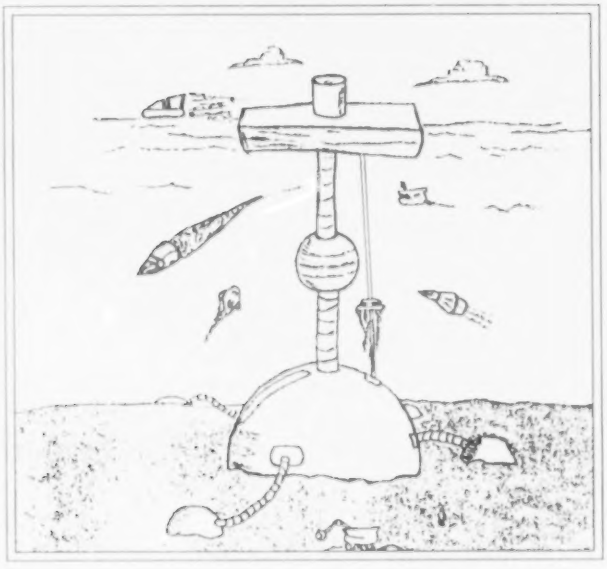
Flying High (secondary)	*Paul Robinson*	pp. 33-41

A unit of study aimed at developing plans for experiments which would be appropriate to conduct on the Space Shuttle through the Get Away Special (GAS) program of NASA.

Search for Truth (middle grades/secondary)	*Jane Schaffer*	pp. 43-46

A humanities unit which stresses the value and meaning of searching and exploring self, others, and the world through literature.

Galactic Colonization for our Future Astronauts



This handbook was developed by the class, Thinkers' Paradise, to show our plans for Galactic Colonization for future astronauts.

The Cataclysm is the ship that is used for the first phase of our project in constructing colonies on a planet in another galaxy. The Cataclysm will be launched from earth many times, carrying materials into high earth orbit to be used in building a space station-travel ship.

This travel ship, the Apogee, will carry fifty people on a thirty-year journey to a planet in another galaxy.

On this special planet, three colonies will be developed that plan to assist each other in colonial life for at least three generations.

Written and illustrated by the sixth grade class at Del Paso Manor School, 1986, San Juan Unified School District, Carmichael, California.

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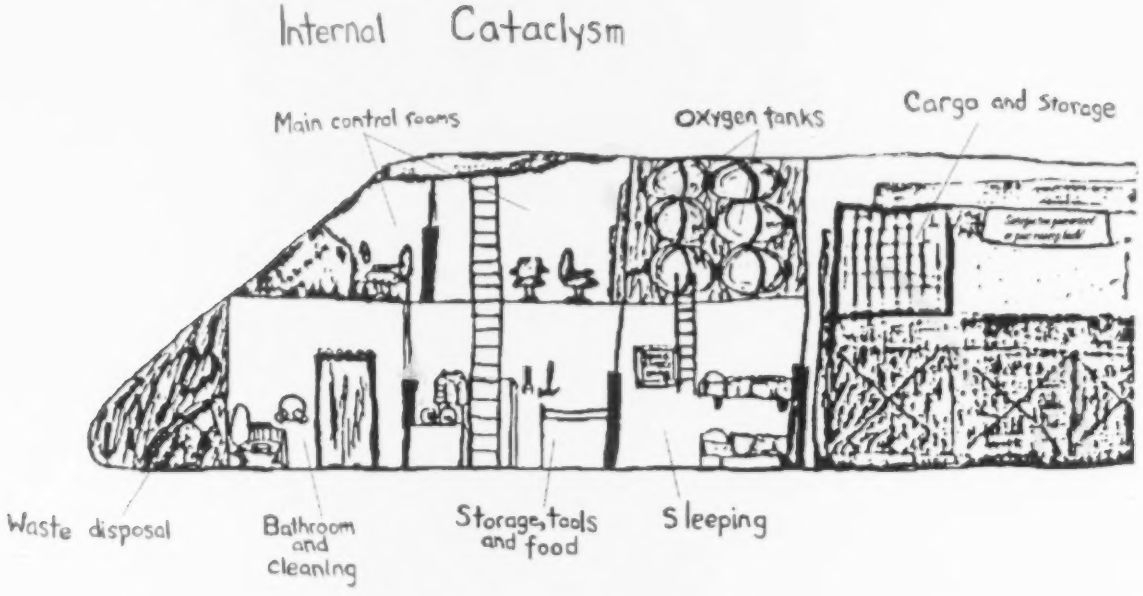
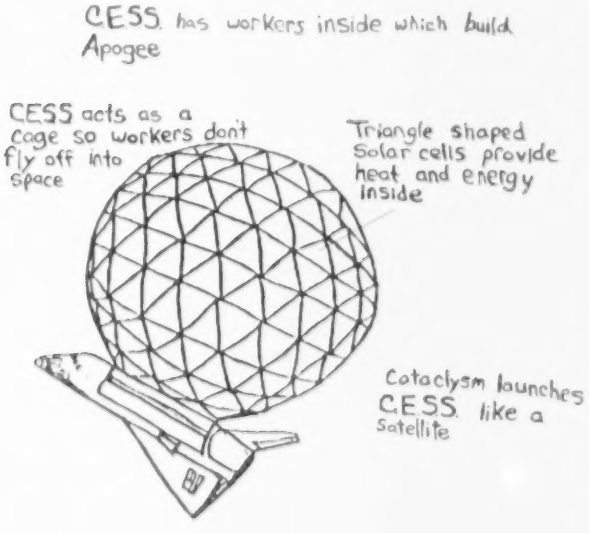
Part I: The Cataclysm
The First Leg of the Journey - Ship Building

Design of the Cataclysm

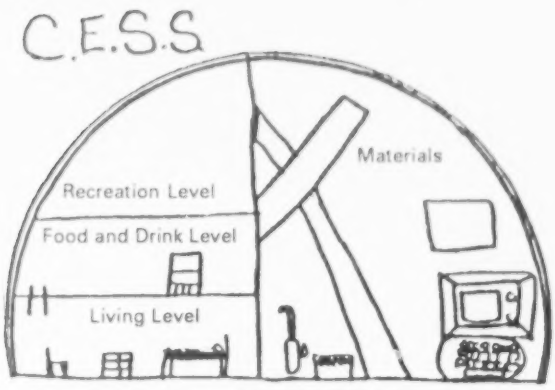


The Cataclysm is built similar to a Space Shuttle to accommodate workers and cargo. It will have a satellite type of craft located in the cargo bay called C.E.S.S. which stand for Construction Expanding Space Structure. It will expand to a geodesic dome comprised of solar panels. This is designed to provide a place to work and from which to build. It is launched out of the cargo bay. The C.E.S.S. will also have four stabilizer jets to keep it in place. It is pressurized and sealed before launch.


CESS has workers inside which build Apogee
CESS acts as a cage so workers don't fly off into space
Triangle shaped Solar cells provide heat and energy inside
Cataclysm launches C.E.S.S. like a Satellite

The Cataclysm has three boosters which provide thrust for the shuttle. When the Cataclysm is about to leave the atmosphere, the empty boosters are carried along to use for structures. The doors of the cargo bay open to extract solar panels and launch the C.E.S.S. The ship is durable, being able to withstand any temperature. The Cataclysm will be able to conduct as many as twenty scheduled flights.

The Cataclysm will be able to accommodate seven different specialists who comprise the crew. The Cataclysm has a large reusable fuel tank that could be cleaned out with a special chemical. The Cataclysm has cargo and storage rooms, personal hygiene centers, food preparation areas, laboratories, sleeping areas, main control rooms, oxygen tanks, and waste disposal mechanisms. The Cataclysm is designed to dock with the Apogee and to accompany it on its voyage to another galaxy.



Staffing of the Travel Ship

In our system of staffing, you may notice that it is modeled after the crew of the Star Ship Enterprise. Seven crew members will be chosen regardless of race, origin, or beliefs, according to their abilities, from every part of the world.

The most important occupant is the captain, who controls the ship, makes major decisions, and enforces the laws within the Cataclysm. Second in command, the co-pilot, assisting the captain, navigates, and in the event of an emergency will relieve the captain of his duties. The co-pilot also has medical training and is able to act as a second doctor.

Third in the chain of command is the communications officer. He or she is in charge of communications with Earth and also between passengers. Next in importance is the computer specialist. This person monitors all systems and also repairs them. The one who performs experiments that will later benefit the Apogee is the scientist who works in all areas. There is also a medical specialist who conducts experiments and treats the sick. The last occupation, but also the most important, is the engineer. This person will handle the functions of the Cataclysm, architectural and design elements of the Apogee. The household chores and the construction of the Apogee will be handled by all of the crew members.

Source and Storage for Materials on Colony

For the trip to this new colony, efficient use of space in the Cataclysm is necessary. It is also necessary to maintain all materials for twenty years or more. To preserve animal life, it will be possible to freeze egg and sperm cells to save space. These cells can stay alive for the duration of the trip.

To conserve weight, we will also produce and use a metal that is lightweight and sturdy. To construct the dome, which will be used for housing and later as a part of the Apogee, we will bring glass-plated silicon triangles. These will conserve space, since the dome will be partially disassembled.

As sources of energy, it will be possible to utilize stars and the sun as sources of light and heat.

Disposal of Waste Products

There will be a trash compactor in the forward area of the ship to compress our craft's solid waste into reusable fuel pellets. For non-recyclable waste, we will compress and jettison it through the air lock. Liquid wastes will be dehydrated and we will store the waste crystals in canisters and will be used later for crop fertilizer after being processed. Selected liquid waste products will be recycled for water.

Flight Plan and Time Table

We will be taking approximately twenty trips to the Apogee construction site. The Apogee will be constructed in high earth orbit, out of the earth's atmosphere in zero gravity.

There will be a rotating 24-hour schedule. After one hour M.E.T. (mission elapsed time), the first shift will start. This shift will last from one hour M.E.T. to thirteen hours M.E.T. Also, at one hour M.E.T., experiments will be performed. After three hours M.E.T., entertainment will begin. Entertainment will be limited in variety. Instruction will be given to teach people building techniques. Housekeeping chores will be done from 14-15 hours M.E.T. Dinner will be at 21 1/2 hours M.E.T. Other meals will be taken as needed on an individual basis.

Housing and Physical Needs for Workers

The basic needs of a worker are food, oxygen, and clothing. The food taken aboard will have been previously dehydrated, deep frozen, or processed by irradiation, a process that uses low doses of radiation to kill bacteria. Food will be easily prepared by heating it in a microwave oven, which is operated by energy that comes from the solar panels. The food storage will be compact and will occupy a limited amount of space. The kitchen facility can be stacked up and folded away.

Throughout the living quarters, there will be a constant and ample amount of oxygen circulating. Trays of very small plants will be carried on board to cycle CO_2 and return oxygen to the environment. Solar panels provide the light for photosynthesis and house the cylinders that contain the trays of plants. The recycled oxygen is filtered and pumped into the living areas.

The clothing will be insulated to keep the temperature moderate. It will be light weight and easy to put on. There will be magnets on both the suit, the shoes, and the floor and places on the walls to allow a person to be stationary, should they have that need.

Exercise is important to keep the body healthy and keep the bones and muscles in good shape. There will be a treadmill and other kinds of exercise apparatus to exercise all muscles. It will be stationary and compact and able to be stored out of the way. Isometrics, isolations of muscle development, will be carried on frequently throughout the day.

During the day, at prescribed times, resting and relaxation is the usual form of leisure. The beds are situated upright against the walls and people fasten themselves into them to rest or sleep. For recreation, the workers can read, listen to music, or just play around.

There are many storage cabinets, lockers and drawers for personal belongings. There is a sliding door for the bathroom, toilet, and other utilities needing water. It is much like the current space shuttle. Each worker will have an individual amount of space to use personally when not working. The furniture is compact and portable and collapsible when not in use.

Beds are upright against walls. They are sleeping bags held to the wall by straps. The sleeping bags can be folded up and stored in cabinets.

Headsets for communication between people in various areas of the shuttle. They are on all the time, but can be stored in cabinets.

Entertainment for people. May include books and music.

First aid kit including bandages, gauze, medicines, and instructions.

Source and Type or Material to be Used

Materials to be used for the construction of the Apogee should have the following characteristics. They should be strong, pliable, lightweight, recyclable, and heat and cold resistant. We also need materials that are easily compacted and stored. Materials from all over the world will be used. We will need NASA's connections with other companies. We will utilize materials from metal companies, plastic companies, and earth's natural resources. We especially need minerals, gasses, and chemicals to get our space program off to a good start. In our earth lab, we will be able to test materials for constructing in the space environment. We will develop the ability to change the chemical bonding and content of metal to make it perform as needed in space.

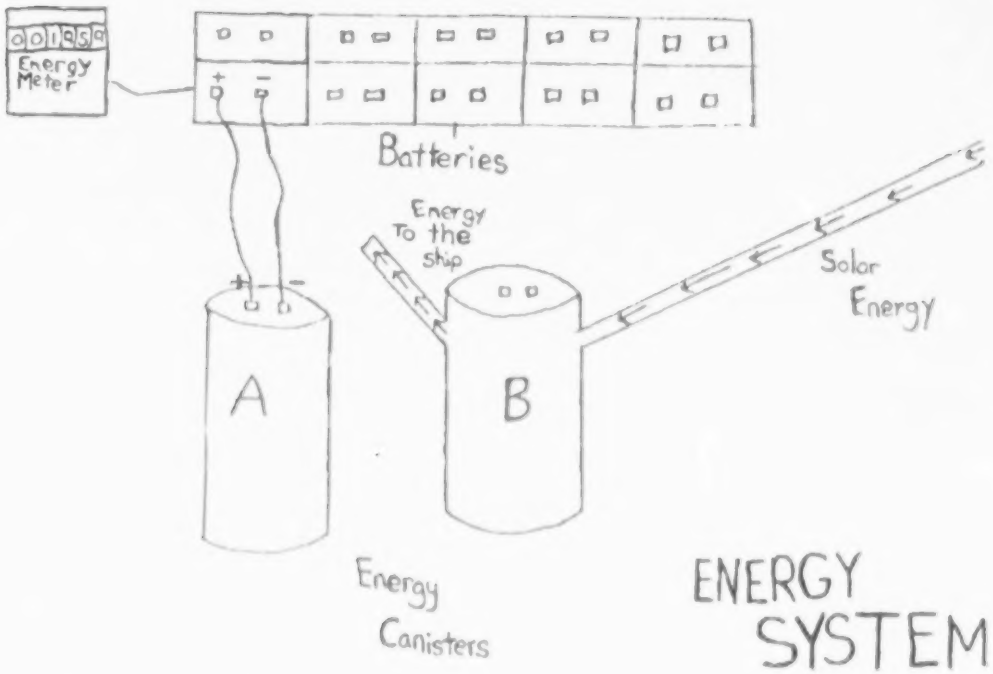
Machines for Processing

In order to use the materials we find, they must be processed. Huge machines shall be used for this. These machines must be able to produce needed structural material quickly and in large quantities. The machines will use three energy sources made available because of the cooperation of all the country's cooperative effort to supply energy. This highly technological machinery will process all parts of the materials without waste. Robotics will be used in manufacturing.

Energy Source and Conservation

The type of energy used shall be solar because it is the most conservative source of energy. In space, we will most likely be nearer the sun, and without the interference of an atmosphere, solar energy will be the most logical choice. A 'sensor meter' is needed to show the amount of energy used and the amount left in the batteries, so that we can use it more conservatively.

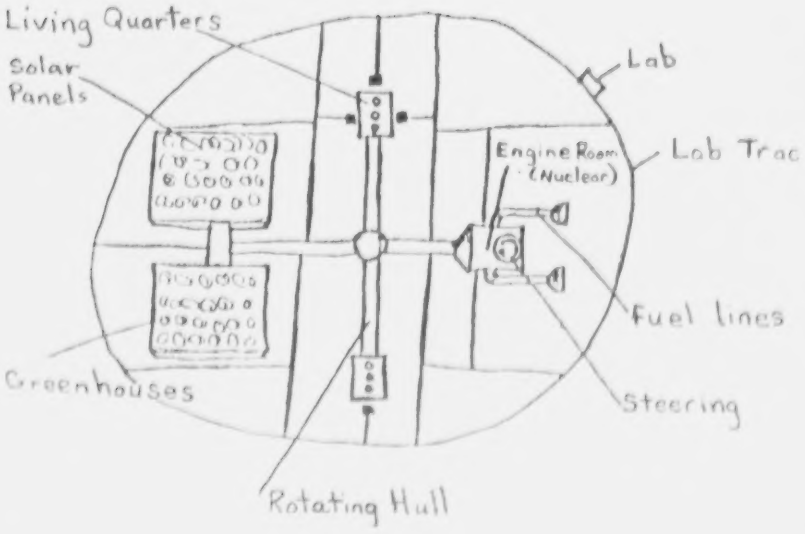
In a small room, such as a generator room, energy will be harnessed and dispersed to be used in the process of building the Apogee. The storage cylinders will be used alternately so that one cylinder can recharge while the other is being utilized. The storage cylinders will be only slightly larger than a car battery. Twelve cylinders will be available for use at any one time. To recharge a cylinder, you simply connect a positive wire (red) to a positive battery post, and a negative wire (black) to a negative battery post. This will recharge a battery in two hours.



In order to save energy, tasks will be permitted ten megawatts a day. The energy will be distributed equally to power electrical tools. Available for use will also be 110 A.C. outlets.

Part 2
The Apogee
Traveling to Another Galaxy

Design of the Apogee



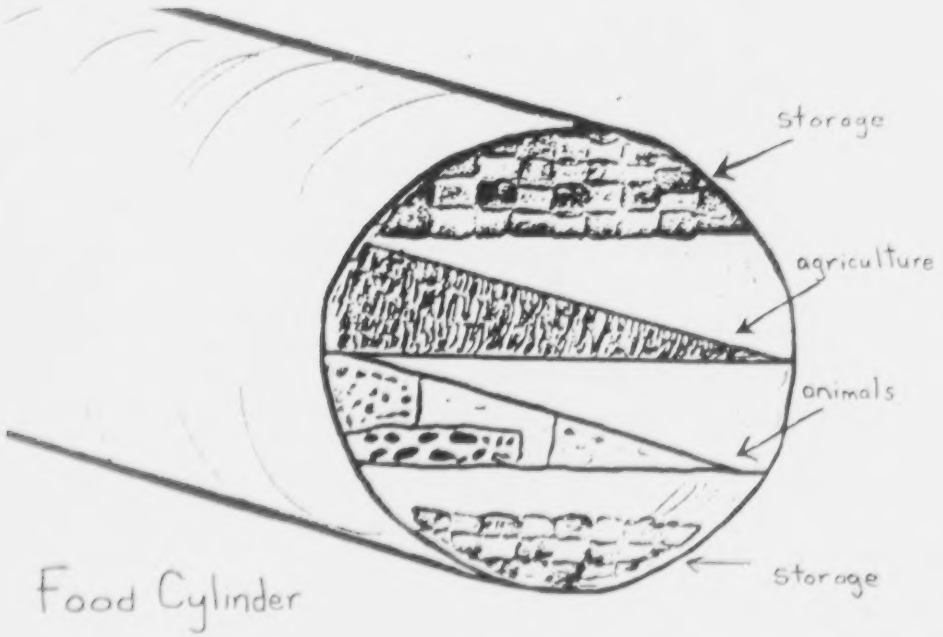
Since the Apogee will be traveling in a gravity-free environment through outer space, it will not be necessary to build a projectile-shaped body for the traveling colony vehicle. It will be built with a center hub, four extending arm structures and a transporting track that will connect all areas together with a vehicle that travels around the circumference of the Apogee.

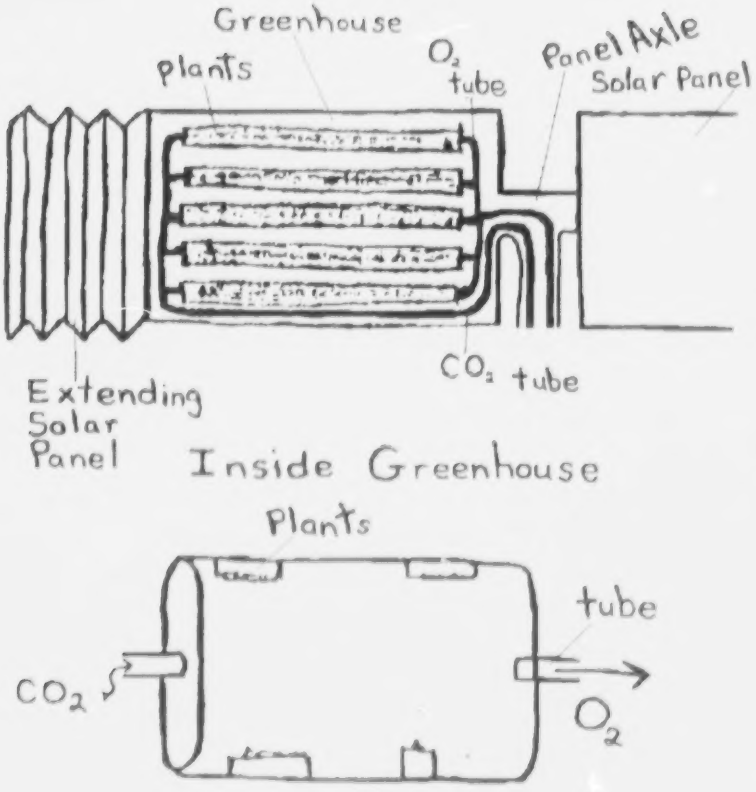
Inside the engine room is a nuclear reactor which provides power. Solar wings provide solar energy for a variety of uses and also serve as a backup to the nuclear power.

The steering mechanism is a large wheel that is connected to the engines by a long girder beam. As the wheel turns, the engine changes its projection and determines the course and movement of the Apogee.

The living quarters are at either end of a long, hollow elevator tube. The large rotating hull of the living quarters turns, thus creating a pseudo-gravitational force.

The solar panels are double sided and have enough room inside to house greenhouses and livestock and storage of materials to be used during and at the end of the journey. Whatever is built in the solar panels will be powered by light from nearby stars as they are designed to be ultra-sensitive collectors.





This stretched cylinder contains plants, moss, baby tears, etc., and spins to create pseudo gravity. The plants collect CO_2 that we give off which goes to the plants that give off O_2. There are hundreds of rows of these inside the greenhouse. The tubes that enter the container also serve as axles. Eventually the axles meet at the panel axle (see diagram) and travel through the hollow axle that serves the places that need oxygen (such as the living cylinders).

Energy

The type of energy used shall be solar because it is the most conservative source of energy. In space, you are most likely be nearer to the sun than on earth, making solar energy the most logical choice. A 'sensor meter' is needed to show the amount of energy used and the amount left in the batteries, so that we can use it more conservatively.

In a small room, such as a generator room, two large cylinders contain all energy to be used in the process of building the Apogee. The cannisters will be used one at a time, to recharge reusable batteries approximately the size of a car battery. This will make an 'Energy Backup System' unnecessary. Twelve of these batteries will be ready for use. To recharge a battery, you simply connect a positive wire (red) to a positive battery post, and a negative wire (black) to a negative battery post. This will charge a battery in two hours.

In order to save energy, workers will be allowed ten megawatts a day. The energy will be distributed to power electric tools. 110 A.C. plugs are readily available.

Flight Plan and Schedule for Trip

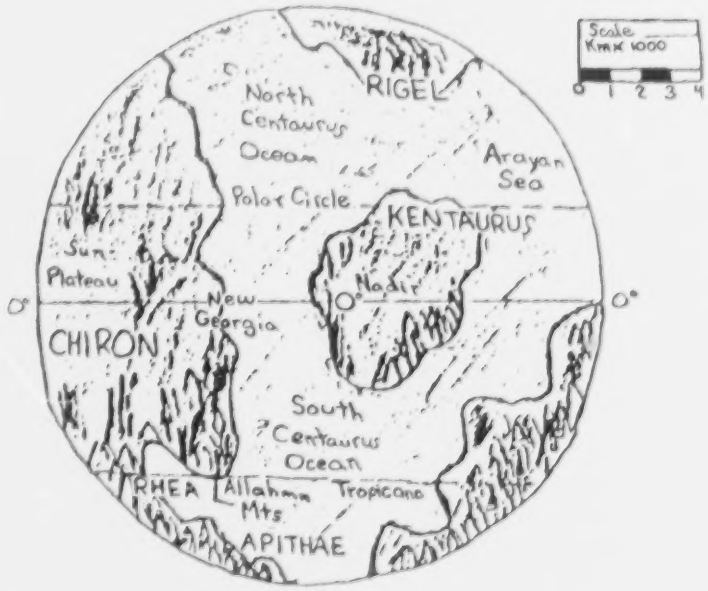
The Apogee will leave earth's orbit and begin its journey to another galaxy, fully intending that this journey will take at least thirty years. Everyone on board the Apogee, man, woman, and child, will contribute eight to ten hours each day in the pursuit of education, operating of the space ship, maintenance of the space ship, and in research and record keeping. During each person's recreational or personally allotted time, each will exercise, study, plan and design, read, relax, and develop interpersonal relationships with other travelers and with family members. Each person's sleep period will be for six to ten hours, depending on need. All persons' schedules will be on a rotational basis, so that work, recreation and rest will be happening at the same time by some groups of people. All schedules will be rotated systematically so that all people will be sharing and working with all people on the trip.

Course and Mother Planet

We establish our course for leaving our solar system with a fly-by of Mars, Saturn, Jupiter, Uranus, Neptune, and Pluto. From our observations of the planets we pass, we can make some decisions on the characteristics of a planet suitable for our colonization. Our ship is traveling at half the speed of light and it takes us approximately thirty earth years to reach our destination.

We have determined the necessary characteristics of our new planet. Our new mother planet is a spherical shape and rotates on its axis which has a 0° tilt. Our planet revolves around a sun star and receives warmth from it. We have chosen our planet because no life forms exist, allowing us to introduce our own carefully selected plant and animal species that have been genetically selected to adapt and thrive well in an interdependent function. There is to be no predator-prey system on our planet and the agriculture is designed to suit the needs of man.

Our planet is about the size of earth's moon and the southern hemisphere is rockier and more mountainous than the plains-like northern hemisphere. The average elevation is 110 feet. The planet is half water and half land. There are salty oceans and many large, inland, freshwater lakes. The water is relatively warm and is rich in minerals. The land and ocean floor have vast deposits of petroleum. The land is abundant in mineral resources that we have commonly used on earth and has a multitude of different minerals available that will be interesting for us to research and discover uses for. The lakes have suitable conditions for the growth of algae and fishes that we have brought with us. The soil is fertile and seems adequate for agriculture. The oceans seem hospitable to aquaculture. It appears to us that we will be able to satisfactorily establish an air, sea and land colony on this planet.

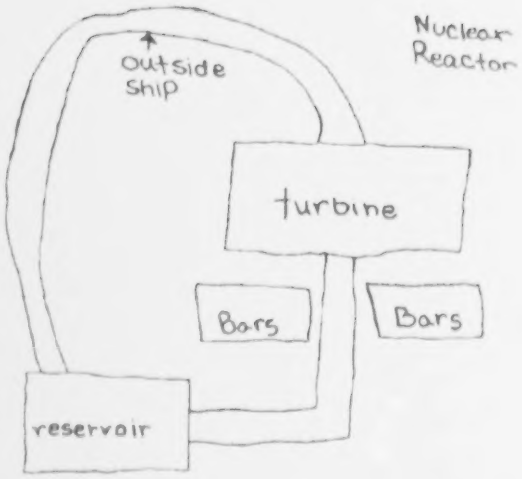


Energy Source for the Apogee

The Apogee will be equipped for energy efficiency. Nuclear power will be used as well as solar power. The grey water that people aboard the ship use can be recirculate and reused for steam generating turbines. The wastes of food can be burned as fuel. Solid human waste can be used in a processed form as fuel.

Our recycled water can be used for heating and cooling by piping it with a hose that goes through the plutonium bars and becomes extremely hot. Then it goes to a chamber with a turbine, and the turbine is powered by steam. Then it travels through another hose, is taken out of the ship and is turned into water by the cold temperature. The water is taken by another hose to the reservoir. In the hot state, the steam can be used for heating and energy, and in the cold state it can be used for the cooling system.

Continued experimenting and research on energy will be conducted during our trip to the mother planet.



Food, Water and Waste Systems

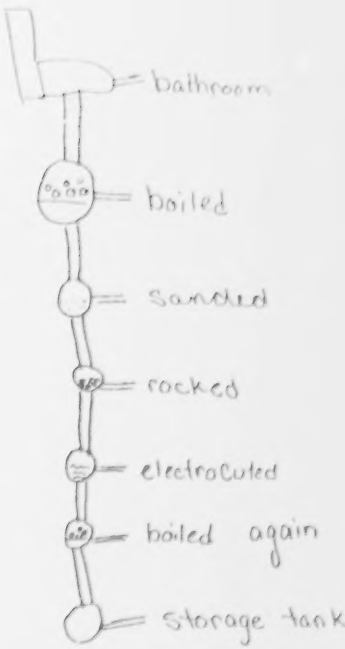
The waste system is an important procedure to keep the spacecraft sanitary. To keep your hands clean there is a 'handwashing station.' Here you put your hands in two holes where water is kept. Here you move your hands around and then take them out. There is a water disposal system so no one will have to wash their hands in dirty water. There is a button to press for soap.

There is a system of dishwashing so the people on the Apogee will not have to eat off of unsanitary, used dishes. This is similar to the handwashing station but is called a 'dishwashing station.' Here you would put the plate, or other eating ware, in one of the holes where a few brushes or scrubbers would clean the plate. There would also be button to push for a squirt of soap. Again, there would be a water system to take the dirty water away.

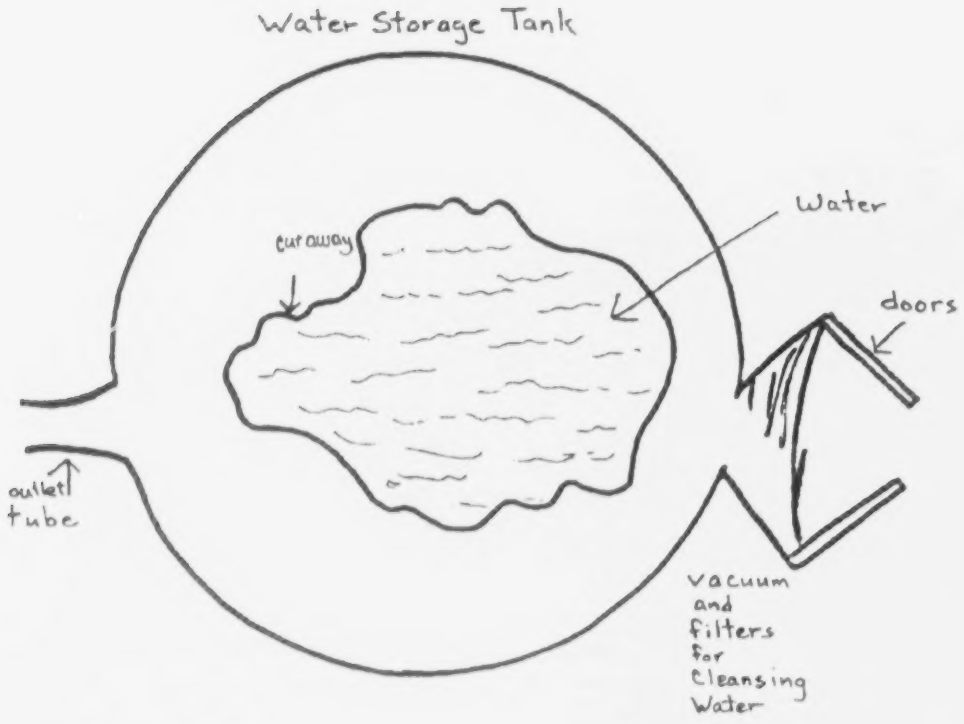
Another system we need on the Apogee is a clothes washing station. Here you would put your dirty clothes in a hole on the front. You would press a button to make the system start. Here it will work just as a regular washing machine dispensing detergent. The water system both gives and takes the water from here. After this you would put it in the 'clothes drying station.' This is mainly like the drying for clothes on earth. You press a button for it to start to spin and for the heated vacuum air to start. This blows on the clothes while they're spinning to get them dry.

Because water will be so important, we will need to recycle human waste. First, after you go to the bathroom, the waste will boiled in a tank (all of these processes happen in tanks inside the wall). Then the urine will pass through sand, then rocks, Then it is electrocuted to remove any more impurities. And lastly, it is boiled once more for cautious reasons.

For trash that can be recycled, we will recycle these items and use them for consumer goods and store these items for further use. Other dangerous items will be sent into the space atmosphere, those are for only the very dangerous, unusable items on the Apogee.



the stages of urine purification



Staffing the Apogee

The crew members of the ship will be chosen regardless of race, national origin or belief, but according to their abilities and the contributions they can make.

The leader of the crew is the captain, who controls the ship, makes major decisions, and sees that the management of the ship and staff is carried out.

The co-pilot, being second in command, assists the captain and, in the event of an emergency, is able to act in his place. The co-pilot also has medical training and serves in this capacity.

Third in the chain of command is the communications officer, who is in charge of communications with Earth, the ship, the crew and any other unknown communicants.

Fourth in command is the computer specialist, who monitors and repairs all systems. He supervises the functioning of all systems.

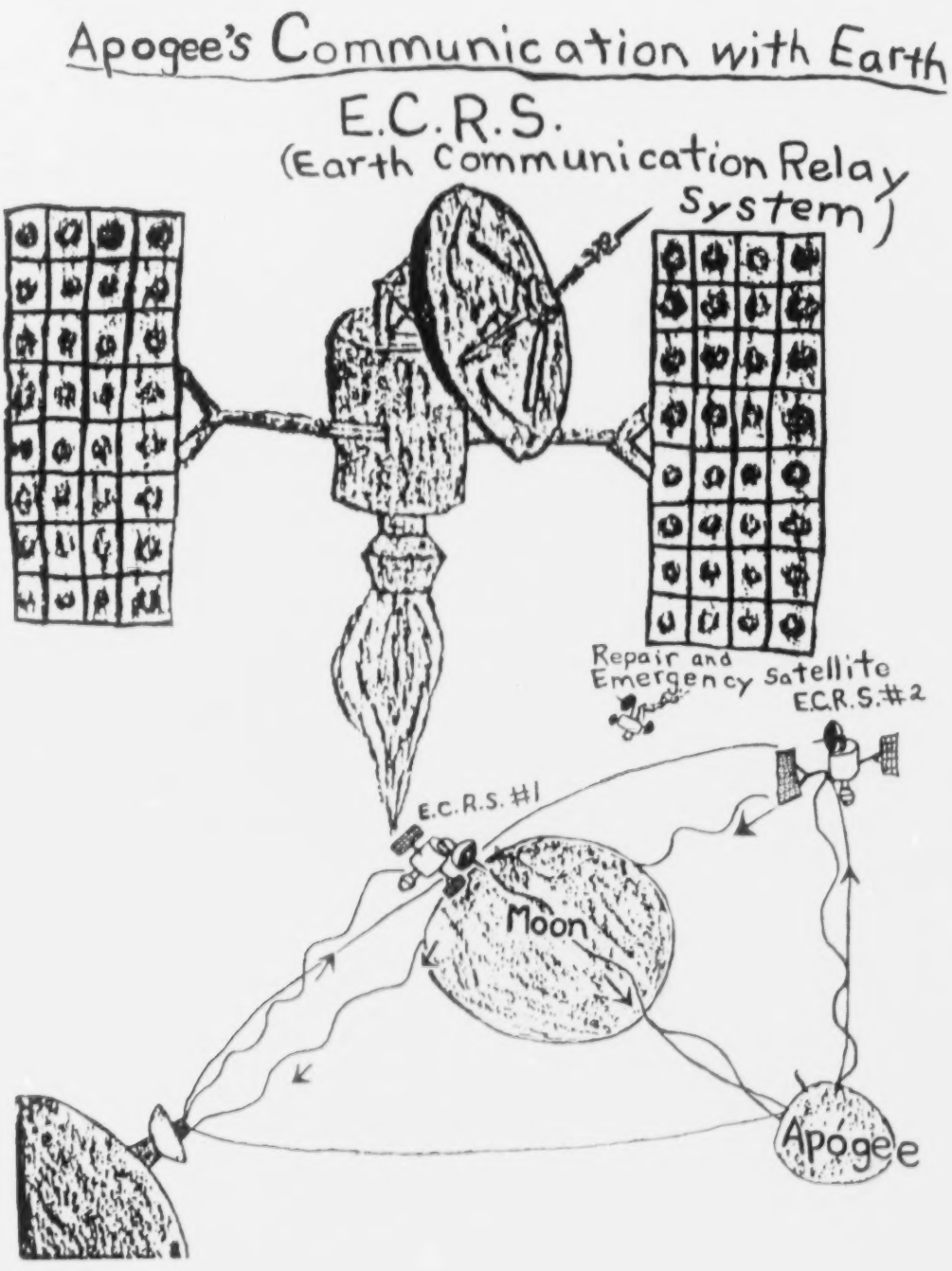
The scientists on board will analyze and research and perform experiments.

The engineer will handle all mechanical and energy functioning of the space craft. He will supervise the crew members as they perform the maintenance and operations of the ship.

Housekeeping record keeping, etc. will be performed by various crew members.

Jobs and Job Descriptions

Factory Workers – People who will work in factories to manufacture goods.
Doctors – Surgeons, Obstetricians, Psychologists, Pediatric surgeons, and other specialists.
Bankers – People to run and care for the economic system.
Repairmen – Repair people to repair all components of the Apogee. They shall specialize in space structures.
Librarians – People to run libraries.
Dietician and Cooks – People to prepare food for colonists.
Janitors – People to keep the Apogee clean.
Farmers – People to work in agriculture.
Navigators – Someone to keep Apogee's direction.
Ministers – People to lead religious activities such as church and marriages and rites.
Salespeople – Clerks and people to run businesses.



Source and Type of Materials to be Used

We especially need minerals, gasses, and chemicals from other countries to get our space program off to a good start.

For the trip to this new colony, efficient space use in the craft is necessary. It is necessary to also maintain all materials for thirty years or more. To save animals, it is possible to freeze egg and sperm cells to save space and provide room for many animals. These cells stay alive for this time. To conserve weight, we can possibly find a metal that is composed of chemicals that link to form a metal. To construct the dome we will bring glass-plated silicon triangles. These might conserve space, as the dome would be in pieces.

Machines for Processing Materials

In order to use the materials we find, they must be processed. Huge machines shall be used for this. Theses machines must be able to produce results fast, and in large quantities. The machines will use up a lot of energy and electricity. This won't be a problem because the whole world is cooperating with this project. There will be only one machine to process all the materials. This should help keep some costs down. There will be one backup machine, if the big one should fail. This machine will be smaller, it will only be temporary until the big machine is working again. If there is a problem with the construction of the machine, we can utilize other ideas from different countries. This machinery will be high-technology machines. The best place to put these machines would be somewhere that no one would be living, but only a few miles from civilization. The machines will process all parts of the materials. Nothing will be wasted. For instance, if a tree was to be processed, the leaves and all would be used for something. These machines will be very useful. When the machine is finished processing the load, it will turn itself off. This should avoid the problems of the machine overheating and excessive wear.

Menu Choices

Breakfast Foods

Peaches	Beef Patty
Scrambled Eggs	Bran Flakes
Cocoa	Orange Drink
Applesauce	Beef Jerky
Granola	Breakfast Roll
Orange-Pineapple Drink	Sausage
Cornflakes	Apricots
Vanilla Instant Breakfast	Assorted Cereals

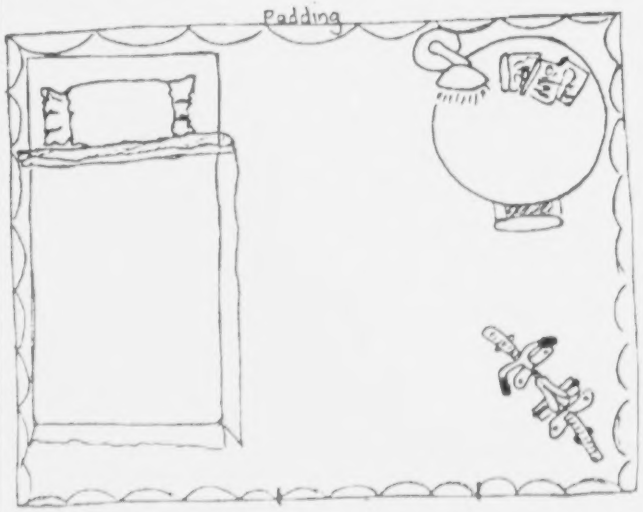
Lunch Foods

Hot Dogs	Turkey
Bread	Bananas
Almond Crunch Bar	Apple Drink
Corned Beef	Asparagus
Pears	Peanuts
Lemonade	Ham
Cheese Spread	Crackers
Green Beans & Broccoli	Pineapple
Cookies	Cashews
Tea	Hamburgers
Macaroni & Cheese	Almonds
Strawberry Drink	

Dinner Foods

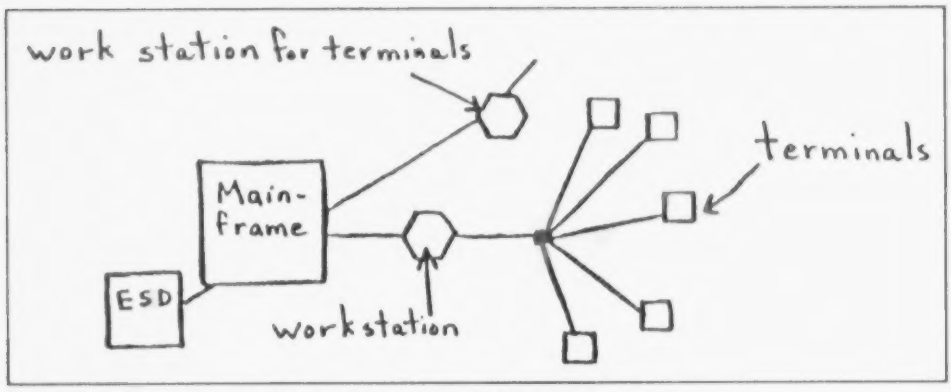
Shrimp Cocktail	Steak
Rice	Broccoli au Gratin
Fruit Cocktail	Butterscotch, Lemon, Vanilla,
Grape Drink	and Chocolate Pudding
Hamburgers	Fettucine Alfredo
Sauteed Mushrooms	String Beans
Pecan Cookies	Cocoa
Mushroom Soup	Turkey
Pizza	Strawberries
Salad	Tropical Punch
Ice Cream	Pies
Coke	Pepsi
Root Beer	

Private and Personal Life



Privacy Chamber (Upper View)

Chamber includes bed, table, chair, books, a light, and a stationary bike for exercise.



Data Storage, Education, and Library on the Apogee

The data storage of the Apogee will be handled by a mass storage device, namely a main frame. The main frame will be linked to terminals via small work stations. The small work stations will be used to meet the demands of many terminals attempting to access the main frame at once. Each work station would work five terminals. The main frame could handle an infinite number of terminals.

The library could be housed in a network of computers, thus eliminating books that are heavy and could be damaged or lost. To check out a book, it is selected from the directory and is then produced on the screen. If required, a hard copy of the books may be made via the printer.

The educational system would be handled by a series of teachers or educational directors. Tests will be given on the computer, therefore eliminating the element of cheating. The computer would then grade the test and issue report cards directly to the terminal in the quarters of the parents of the students. They would authorize seeing the report and receive suggestions from the educational director as to their course of action to enable their children to improve.

Education is much the same as it is on earth, except for college. To become a 'certified professional,' you must complete the course work and the examinations and also become an apprentice for one year.

Government

The long-term government for the Apogee is a democracy based on accepted, legal rights. There is no written paper discussing the government except this. As problems are brought up, they will be discussed and agreed upon.

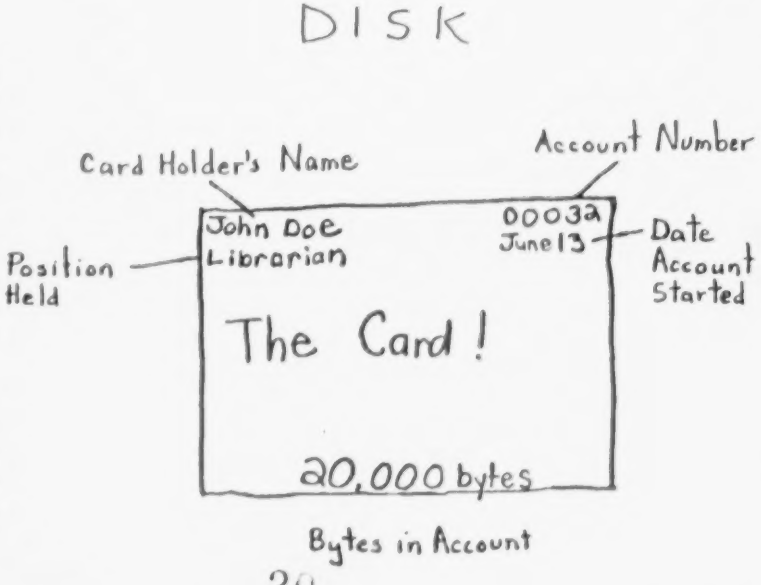
The primary officers are the President, Vice-President, and a Secretary. Because of the absence of material currency, there is no designated Treasurer. Instead, the Secretary will keep track of the accounts. All others will be assembled in one Cabinet. The people, before leaving the stratosphere on the Apogee, will elect these primary officers.

Economics

A monetary unit will not be necessary. Instead, each person will have his own disk at the bank. It starts out blank and your salary of 'bytes' is added to your disk. To prevent bytes getting into the trillions, minimum wage is one byte an hour. Wages will remain stable, as there are no unions.

Each worker carries their own computerized plastic card, which displays the amount of bytes of his/her disk. These are color-coded by amount, i.e., 1-10,000 bytes = blue, 10,000-20,000 bytes = red, etc.

Upon purchasing an item, the account number located on each card is typed into a computer which communicates with the bank. Then the price of the purchase is deducted from their disk. These disks can



hold an unlimited amount of bytes. For overtime, extra bytes are obtained.

The only purpose of the bank is to keep track of the disks. A card can be obtained by anyone with bytes, including children.

If proven to be needed, pensions will be available for ten bytes a day for those unable to contribute work.

Also, on the card is the holder's name, occupation and date the account was started. The sign for a byte is a 'c' with a dash through it.

Physical Care aboard the Apogee

Medical care and research on the Apogee will utilize all the latest in research techniques and apparatus. Continued research will continue to advance the present understandings, techniques, and tools.

We will develop and maintain medical facilities for the sick and injured. There will be small stations and isolated rooms available for checkups, care, and study.

Research into genetics will be continued so as to detect deformities before birth so that they can be corrected while the fetus is still in the mother.

In the lab, with the benefit of sterilization and zero-g, scientists will be able to develop vaccines for diseases that have not yet been cured, such as multiple sclerosis, AIDS, cancer, diabetes, muscular dystrophy, and leukemia.

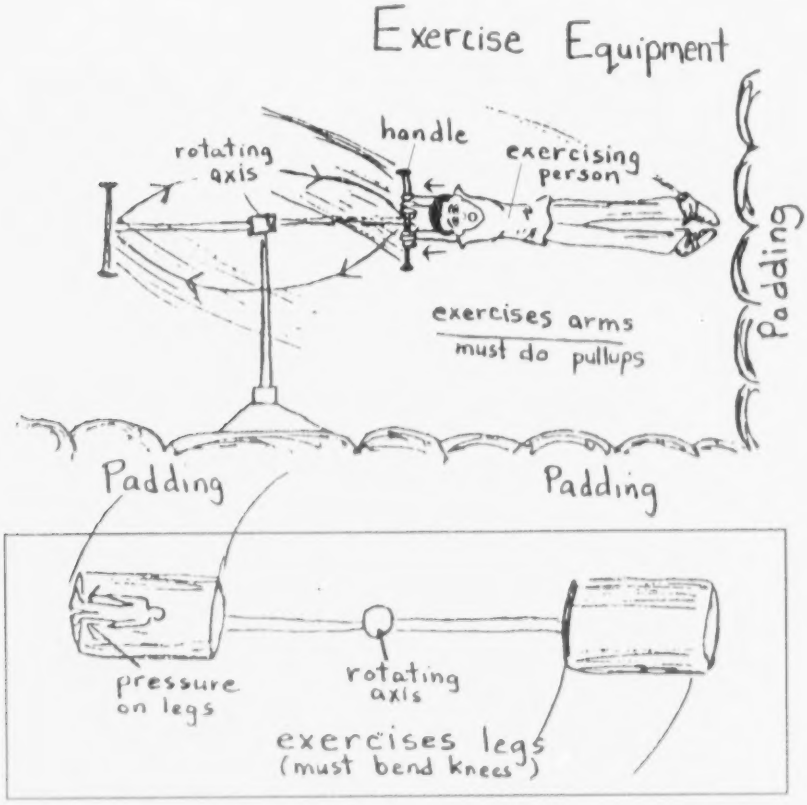
We will take with us young scientists and doctors so that they will have a long period of usefulness when we are establishing ourselves on our new planet. Then they will have the opportunity to use their experience and trained minds to problem solve and train the successors.

If we are to be on the Apogee for thirty years, there most certainly might be psychological problems. Patients with severe disorders will be placed in isolation and monitored. At least two counselors or psychologists could be on duty to counsel patients who need help with problems. Before the departure of the Apogee, tests could be run to determine one's capability of reacting correctly to a situation under stress. Tests to determine one's greatest fears can be run and therapy given to assist the patient to overcome these fears.

Recreation
Soccer
Sports without Gravity would need very different rules
Basketball
There would be simple TV stations, Since everyone on the ship knows each other and there are so few people, the evening news would take about ten minutes.
Today George finally learned to like spinach.
Replicas of earth life will be brought on board ship for generations who would never see earth.

Recreation

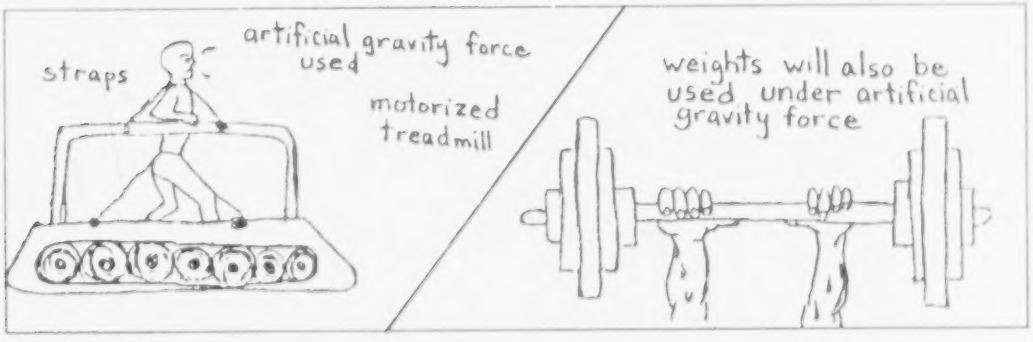
A lot of hard work is put into being an astronaut. However, the astronauts need some recreation. While in space, games similar to those played on earth, will be played in the zero gravity atmosphere of the living quarters. These will be played for exercise and enjoyment. Obviously, the rules will be slightly altered due to the weightlessness of space. Educational games using video and computers will be available for recreation and will be selected for their effectiveness on mind stimulation. Video tapes will be used for relaxation as well as books that are projected over a video screen. New methods of relaxation and recreation will be developed throughout the trip's duration.



exercise classes

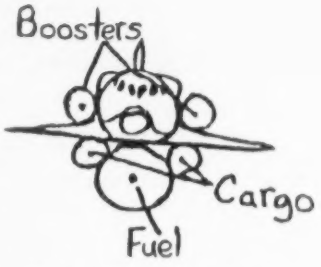
neck muscles exercised
hip muscles

charts kept on people's health and people who are not in top health take special classes.



Part 3: Colonization in a Far Galaxy

Reaching our Destination



The Cataclysm

Upon arriving at our mother planet, we explore and search for a temporary settlement location. We establish a location in orbit around the planet with our space ship and now make our travel vehicle a space settlement.

After having explored our new environment, we establish three colonies. One colony will orbit the planet, one colony will develop a land-based settlement, and a third colony will develop an underwater-based settlement.

We will explore our new planet and the surrounding galaxy. For the exploration of our planet, we will use special devices that will sense, interpret and analyze, record and transmit information. We will look for any kind of microscopic or easily visible life. We will test different areas of the land for special resources or minerals that exist on the surface, under the surface, and under the water. The planet will be explored and charted and mapped.

We will also be studying the new galaxy. We will use our ship, the Cataclysm, as an exploration vehicle, as it is able to dock with our orbiting space settlement, as well as land on the surface of the new planet. We will look for celestial bodies and map our findings. We will also analyze the air and look for special stars, planets, and moons.

The Moons of ANTHRAX

Zircon

Zircon isa semi-precious stone, used in making diamond substitutes. This can and will be used in trade.

Antron

Only liveable moon

Voltaire

Zenith

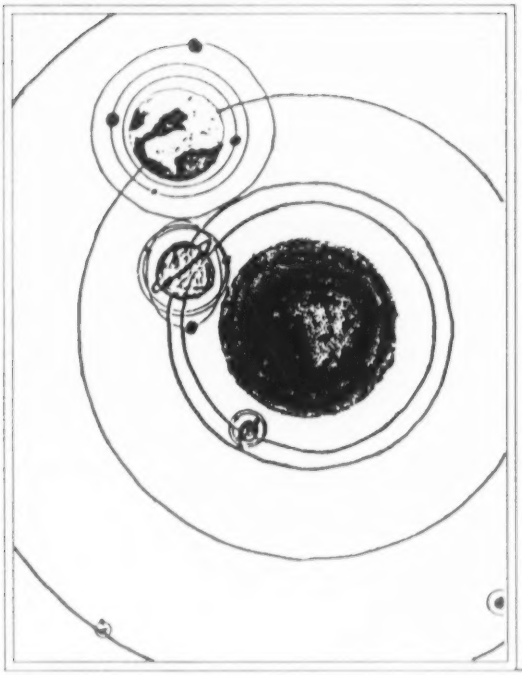
The back-side of Antron

Materials for the Air, Land, and Sea Colonies

Natural resources of our new planet will be the main source of materials for all construction done for our colonies. Our highly trained research scientists can chemically analyze the molecular structure of found materials and through the engineering processes can enable us to develop new materials for constructing the various products that we need.

Soil and hydroponics will be used for the growing of crops for food for humans and livestock. Soil will also be the home to worms and insects that are useful to plant growth and propagation. The growing of plants will enable us to maintain a closed environment cycle of oxygen, carbon dioxide, nitrogen and hydrogen. Plants and animals will be raised in each colony.

The rivers, lakes and oceans on our planet will be very important for their waters will be used for many things, including trans-



portation, irrigation, aquaculture, and energy.

Many of the materials on one colony will be transported to another colony that lacks that material. Colonies work together in helping each other with the necessities of life by sharing the natural resources found near each colony.

The resources of the sea colony are seafood, seaweed, oil, salt, water, minerals, and the products of industry, gas, glass, silicon, pearls, soap, and hydroelectric energy.

The resources of the land are minerals, oxygen, oil, solar energy, and the products of industry, agriculture, livestock, fertilizer, medicines, glass, silicon, sulfur, magnets and products for clothing, furniture, and structures.

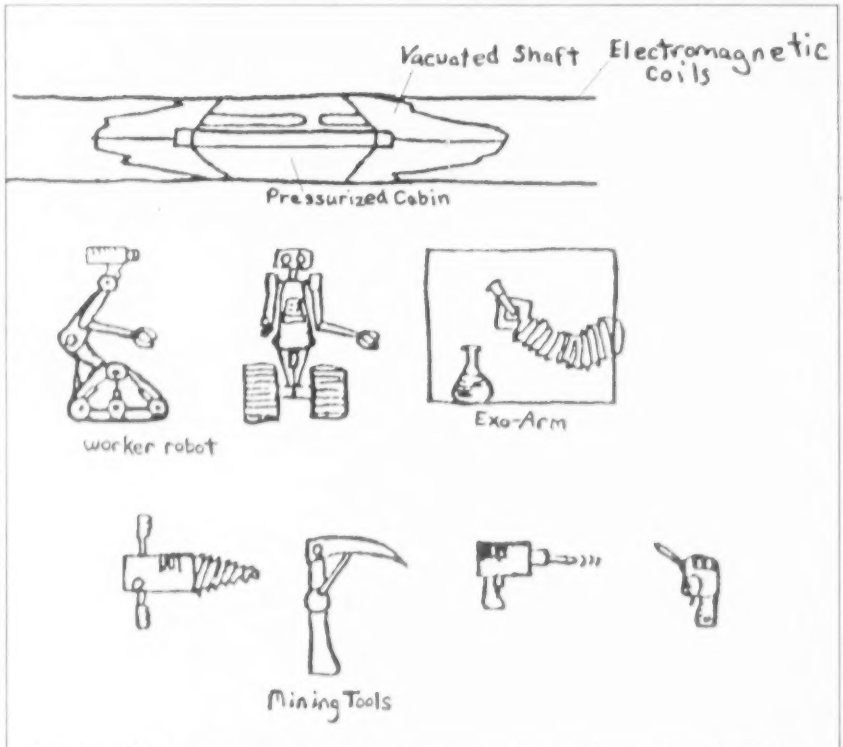
The resources of the orbiting colony are solar energy, oxygen, and other chemicals, and the products of industry such as crystals, new materials, medicines, and scientific technology as well as the communication system for the planet.

Air Colony

The colony that orbits the planet will be called the Air colony. It has two basic shapes to its construction. It has a hollow tube structure that will be used for facilities other than housing. It will have cylindrical housing structures rotating on a central hub.

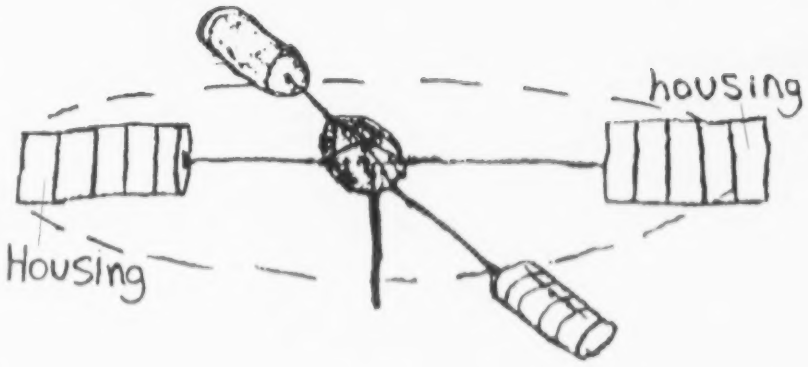
The housing development is unusual but workable. The circular houses are stacked up making a cylinder. Four cylinders are at each end of two bars, the center of the bars has a turning axis making artificial gravity. There are five houses for each cylinder.

To insure sturdiness, all beams and poles will be made of Sant, a mixture of iron, metal and other metal recyclables. Instead of insulation, a pressurized shell covers the outer part of the ship. Floors and counters will be made of Coricon, a popular white marble/tile. A system of G.L.S.B, Grid



Mining shafts are necessary to have access to the precious minerals within. A small sub-like car travels inside the vacuated tube, therefore there is no friction. The tube is coiled with electromagnets which push it back and forth. Worker robots are used in the dangerous task.

Lock Support Beam, out of sant totally assures safety from structural collapse. ATOMS, building robots, are programmed to build fast and efficiently all of the predesigned structures.

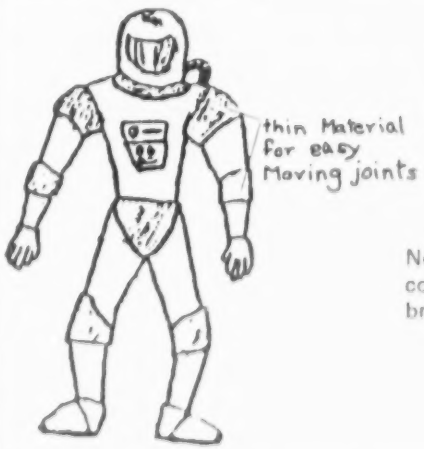


Poly-glas, a fireproof glass substitute, is used in all areas to create a beautiful view of the planet. Balconies are set aside also for a panoramic view. All walls will be three-quarters of a foot thick, containing water pipes and electrical circuits. Made partly of metal and partly of plastics, these walls are sturdy and inexpensive. There will be several housing developments branching off from the central colony tubular structure. Inside the houses will be various pieces of futuristic furniture. A chair might glide over the air and be steered by the person sitting in the chair. The chairs will be powered by air that is sucked through openings and flushed out the bottom to keep the chair afloat. Some windows on the house will be large and will allow extra light in, thus saving on energy. Many of the windows will allow people to see out, but not allow others to see in. Within each housing development is a playground for children. The houses will have two bedrooms, two bathrooms, a kitchen, dining room, a living room, and a large closet. An extra room is available and can become a bedroom, playroom, recreation room, or an exercise room.

The air colony is connected by tubes. These are the remains of the tubes connecting the Apogee. A bullet train runs through the center near the top of the tube, providing transportation. Next to the bullet train are the bike lanes and pedestrian walkways. Underneath these lanes are pipes carrying various needed commodities, i.e., water, fuel, cargo, etc. Below this there are recreational facilities, research labs, businesses, industrial parks, and other facilities.

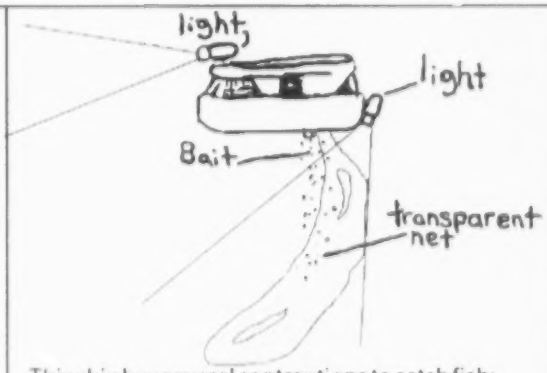
Water Colony

The domed and cylinder-shaped watertight structures under the water house many colonists. Places of employment for undersea production and services can be carried out in areas adjacent to the housing centers. Mining and the extraction of petroleum and natural gas from under the ocean floor will be carried on by vehicles designed to perform such tasks. Aquaculture of many types will also be conducted to provide nutrients for people from all three colonies. Research will be conducted to find new methods and uses for resources available. The water colony will be interdependent with the air and land colonies and will travel back and forth between them.



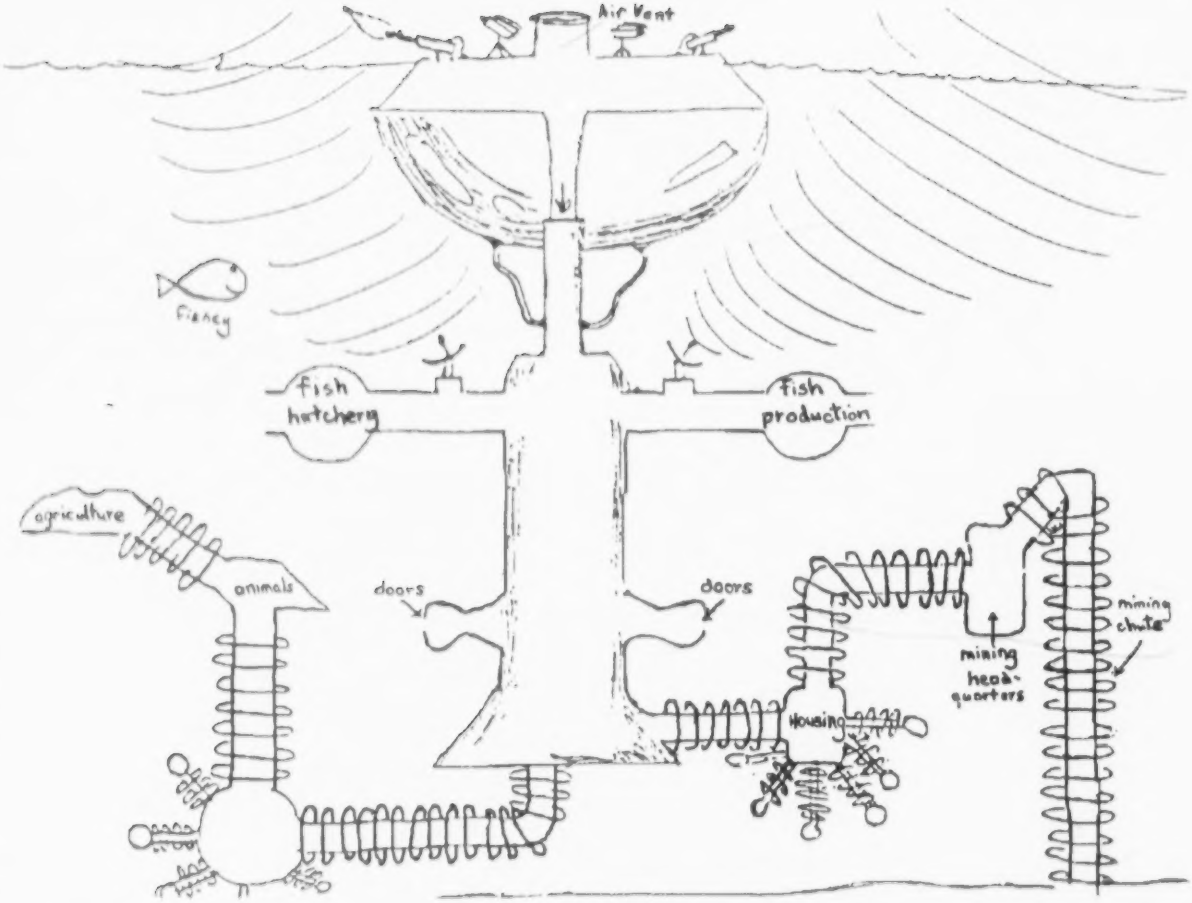
For easy transportation by walking, people slip into a suit which supplies air and heat.

Nose Capsules have compressed air for breathing underwater



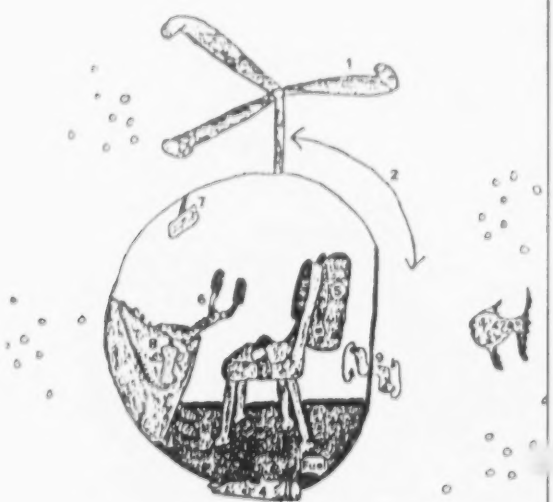
This ship has several contraptions to catch fish:

1. Several kinds of squid and fish are attracted to light.
2. This ship has bait to attract fish.
3. There is a transparent net scented to attract fish which is brought into the ship once filled.



Key to the Automobubble

1 Helicopter-like blades with rockets for steering
2 Shows repositionable directions for blades
3 Fuel tank opening (on bottom of Automobubble)
4 Repositionable direction of rockets
5 Emergency air-tank
6 Steering joystick
7 Rear-view mirror (bubble is clear)
8 Bubble-to-bubble and Bubble to colony telephone
9 Handle for door



Automobubble™

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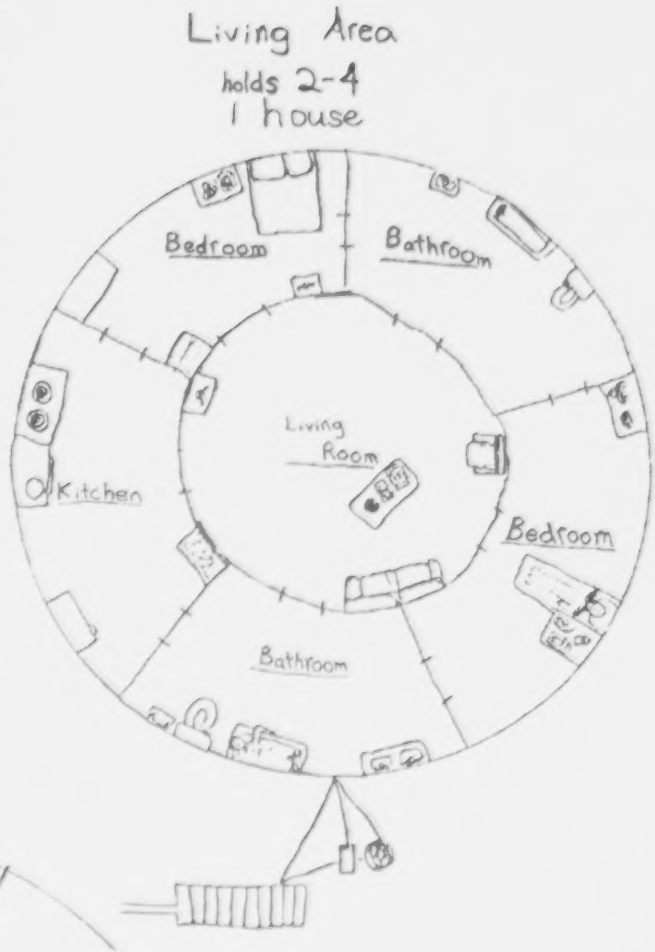
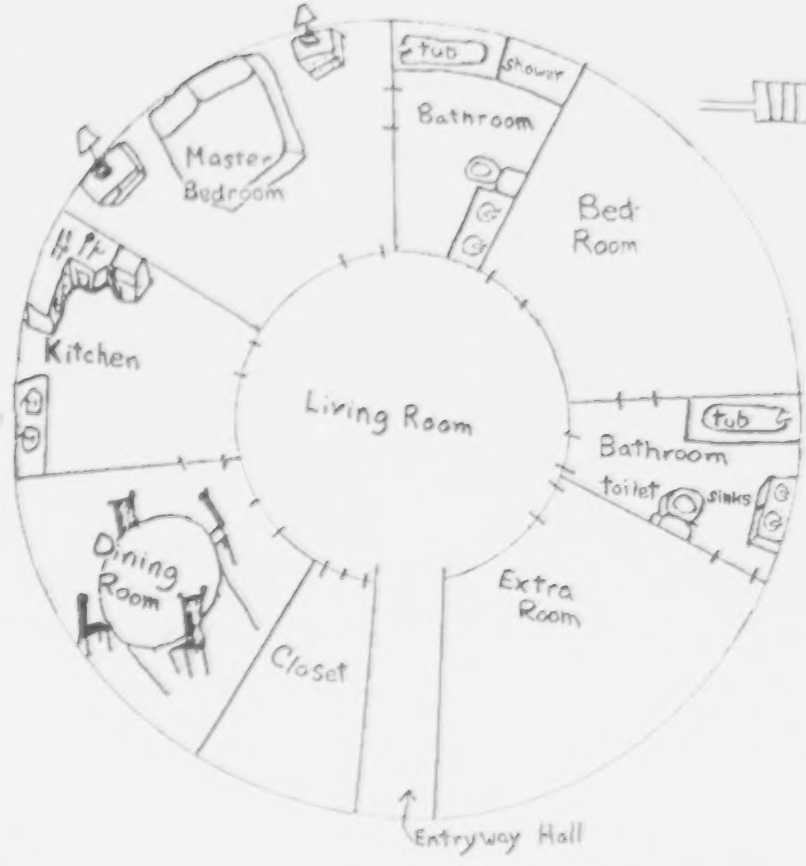
Land Colony

The land colony will be able to use a larger area to spread out and develop as it does not have the natural confines of water or the orbiting in the air. Many areas will have domes over them to enable the colonists to secure the exact environmental conditions that they desire. There will be biospheres used for agriculture and research will be conducted constantly to enable the colonists to adequately produce the nutrients necessary for survival. Food will be transported in a processed state to both the water and air colonies for dispersal to the colonists there. Items that are needed by humans will be dispersed and distributed in a fair manner without cost as nutrients are one of the basic human needs.

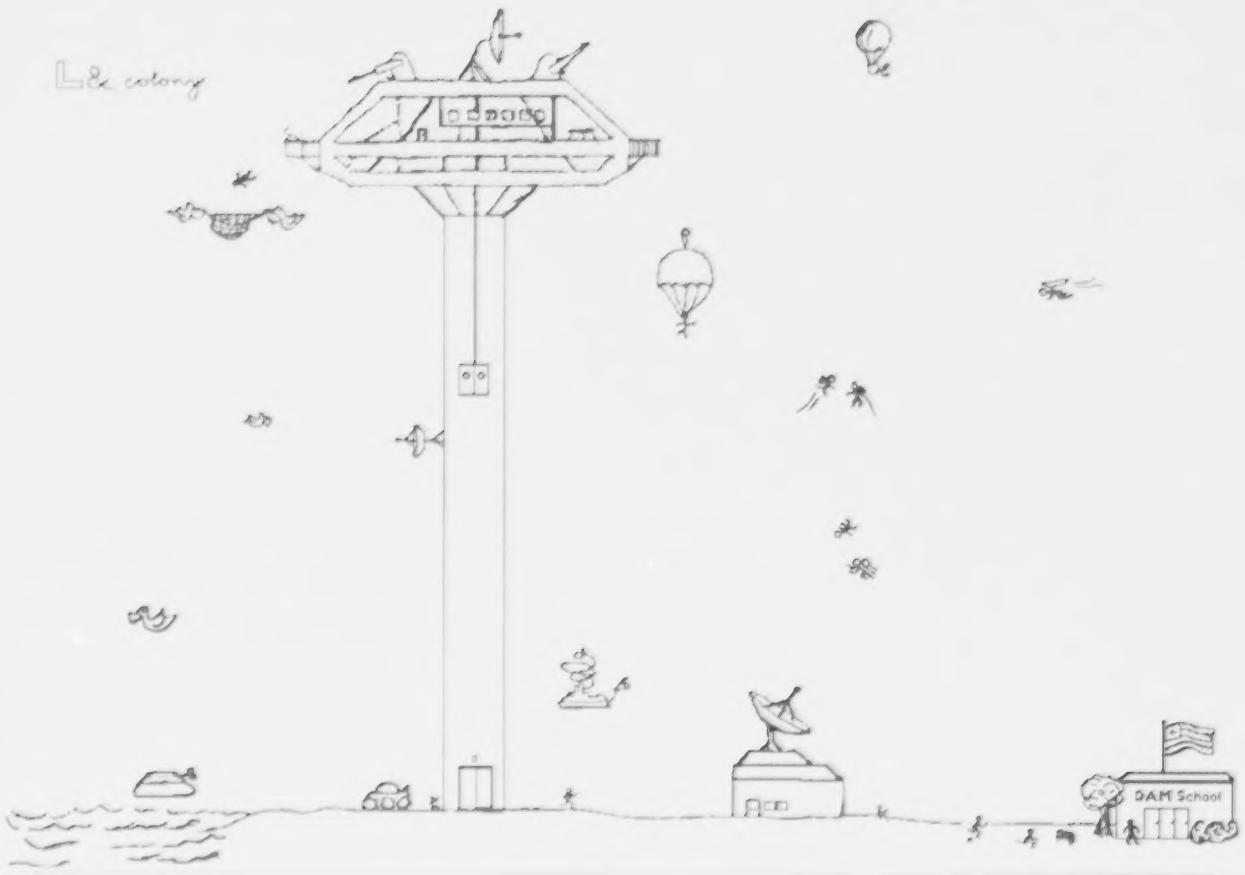
Utilization of the land will be explored, researched and conducted in all areas of the surface of the planet. Industrial facilities will be developed near the resource and materials will then be transported for manufacturing closer to where the colonists live.

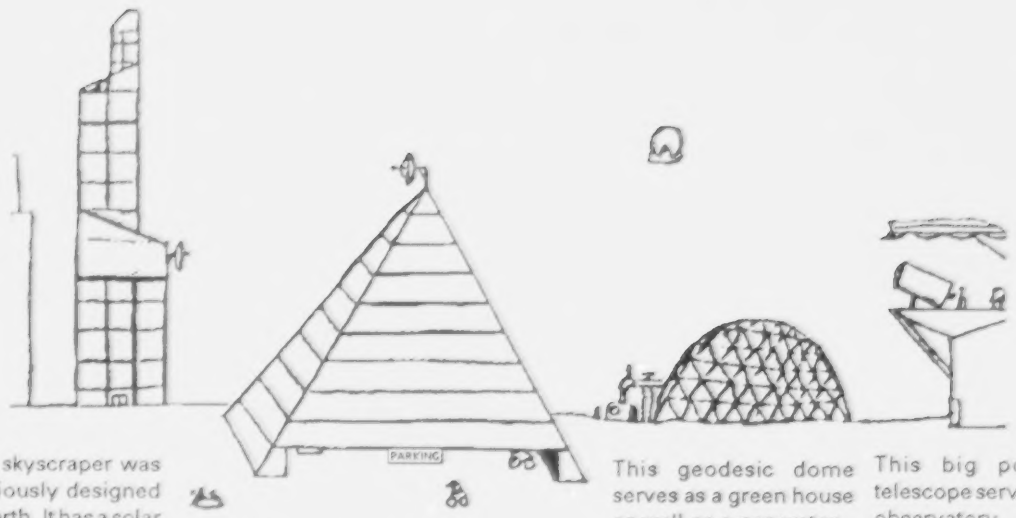
The land, water and air colonists will share needed commodities and will have a cooperative interdependence.





Floor Plans of house units





This skyscraper was previously designed on earth. It has a solar collector for power.

This pyramidal building serves as a large durable building that is earthquake proof. It has a solar collector.

This geodesic dome serves as a green house as well as a generator.

This big powered telescope serves as an observatory.

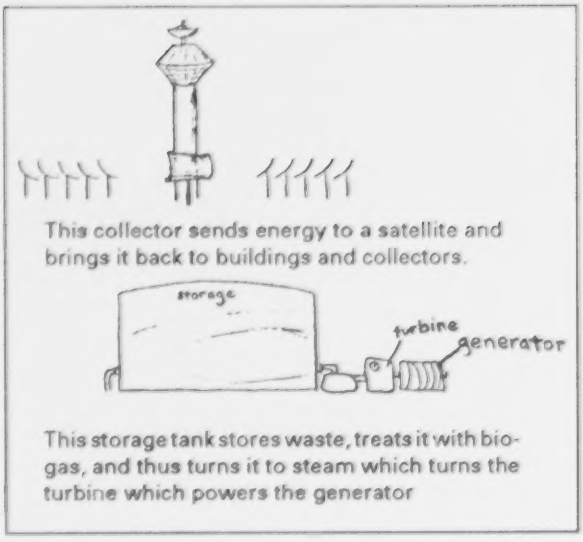
Nuclear N-R-G

Nuclear energy for the colonies could produce 75% of the total power. The rest of the energy needs would be supplemented with solar energy, which could also back up the reactor in case of a problem.

Nuclear energy is safe is space, because if there is a meltdown, the reactor unit can be jettisoned. The vacuum of space will dissipate the radioactivity and it will be reduced to nearly nothing. There is no waste created from the closed Circuit reactor.

The reactor begins with a reservoir of water that is pumped into the reactor's plutonium rods. It is turned into steam which drives a hydroelectric turbine. After it does this, circulating fans use the heat to heat the colonies. Then it is pumped out of the chamber where it is cooled. At this point you can use the water for cooling. Then the water is put back in the reservoir and the process is started over again.

The rods will not decay fully for the duration of use. The half life is when you have half of something. In this case, it is close to 40,000 years.



This collector sends energy to a satellite and brings it back to buildings and collectors.

This storage tank stores waste, treats it with biogas, and thus turns it to steam which turns the turbine which powers the generator

Government

The Old form of government, used on the Apogee, has to be abandoned in its functional sense. Each colony will use the same procedures that were used for all people on the Apogee, but there will necessarily be changes. There shall be some new additions to the primary officers. These are to include a governor for each colony, who is the head representative of the people, and a patrolman, who takes care of peoples' material needs.

Meetings are held every two weeks, in the colony, and every month for the joint commission of all colonies. Elections for all offices are held every six months and there is no limit to the number of terms for one person to hold an office.

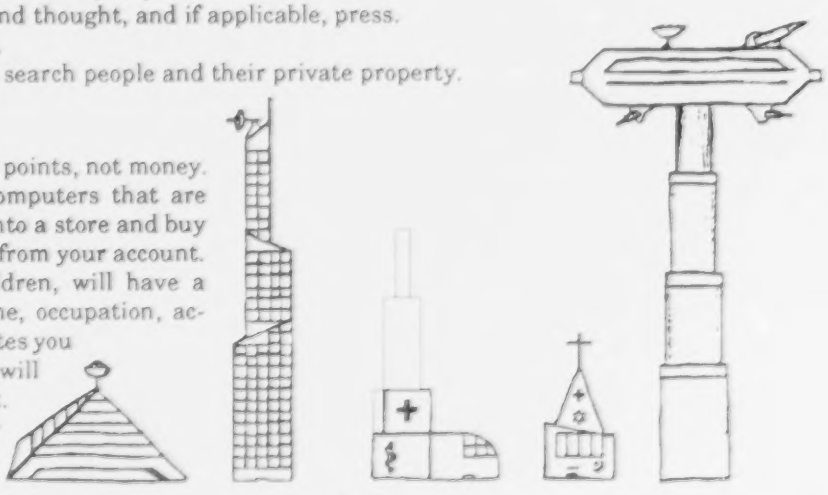
The following laws can be amended to suit the majority of the people at any time. A wish to amend a law must be referred to a primary official, who will bring it up for discussion at a colony or joint colony meeting.

1. If one marries, after having a child, they must stay married to the same person at least until the child enters college.
2. One must start school at the age of five if aptitudes indicate that the child is ready.
3. All high level projects should be referred to for analysis by Ph.D.'s.
4. People with M.D.'s are the only ones allowed to perform Medical services and operations.
5. Criminals should receive a fair and speedy trial.
6. There is freedom of speech and thought, and if applicable, press.
7. There is capital punishment.
8. One must have a warrant to search people and their private property.

Economics

In our system, bytes are like points, not money. All stores are equipped with computers that are hooked up to a bank. If you go into a store and buy something, bytes are subtracted from your account.

Each person, including children, will have a Credit card that says your name, occupation, account number, and how many bytes you currently have. Each person will have his/her own disk at the bank. The disk starts blank and salary is added as it is earned. To obtain the bytes, you must type



in your account number at the bank. Disks hold an unlimited amount of bytes. For working overtime, you get extra bytes.

All of the institutions in the colonies, including industry, operate with a byte, disk system.

Careers

There are many people needed in space to perform the necessary jobs for existing on the new planet. Some of these jobs are pilots, teachers, research specialists, dieticians, agriculturalists, manufacturers, maintenance officers and engineers.

Pilots are crucial to our transportation system. Teachers are vital and the new generation of citizens born in flight and at the colony will have much to learn. They will need to be trained in endless new ways in addition to all the ways their parents and grandparents were trained. While we are in space and on our new planet, we need to be constantly advancing in technology. Various career opportunities are available to maintain our existence and to prepare for the years to come. We must always be thinking of new, improved ideas and we must communicate with earth to share ideas about our present technology.

Educational System

All three colonies need a strong educational system since there is so much for every colonist to learn. Each person should have a good education in order to make a contribution to the Colonies. Earth sciences and history, communication skills, and space and high technology subjects will be taught.

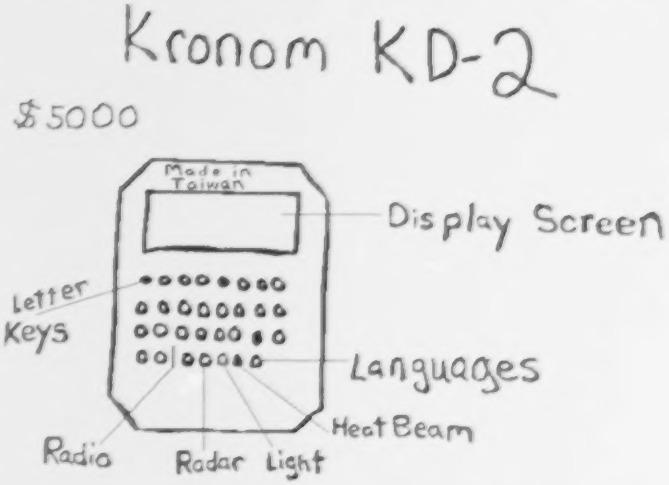
The students from the ages of five through eighteen will attend school daily. College is greatly urged, but is optional. The kindergarten daily learning hours are 12:00 P.M. to 3:00 P.M. Grades one to twelve are from 9:00 A.M. to 5:00 P.M. When you have finished school you are to meet a goal that you have set. You may set your goal for a Masters of Science and Technology or a Masters of Management, or you can prepare to be a technologist.

There will be no I.Q. tests, but you are tested by the government to determine your aptitude in various areas. There will be an evaluation means to determine if you are prepared to serve in the profession you have chosen.

There will be an apprentice program where those people educated in performing skills will educate future generations.

Teachers will only teach one specialized subject and will teach it on different levels from general to great depth.

There will be more subjects to learn, namely those dealing with the exploration, utilization and characteristics of the newly-founded planet. Through communication with earth, new discoveries can be broadcast to augment technology on earth.



The Kronom KD-2 is a computer watch which has many features. A radio allows the bearer of the watch to communicate with other Kronoms and C.B.'s. The computer allows contact with other computers. The light can project a beam of light up to 30 feet. The radar can detect hidden objects within a 100 meter radius. The heat of 30° F - 100° F. The final feature is that the Kronom can learn any type of language.

Institutions

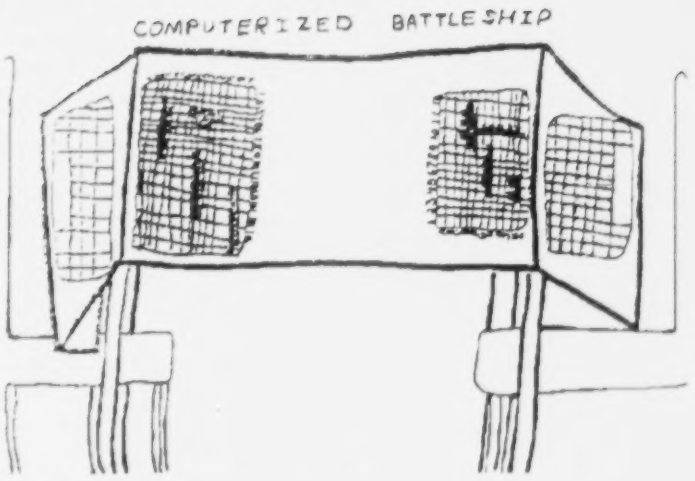
In the Colony, the people will be provided with beneficial organizations and institutions. For the older citizens, the infirm, or the mentally ill, there are care facilities in close proximity to the family residence. The government will care for all people financially as will they for orphans, until they can be taken in by a family.

Churches will uniformly allow all people to worship in a manner suited to their individual needs.

For those who have committed a crime, institutions will be provided to isolate them from other citizens until their criminal nature is corrected and they have been rehabilitated.

Work will be so rewarding that there will be no need for a welfare system for the unemployed. People will continue to make valuable contributions to the colony until the time of their death. As people become older the amount of time each day or week that they need to make the work contribution will lessen, but they will still feel useful and needed. There will be adequate income for them during their declining years.

Recreation



Exercise and recreation will be necessary. There will be health clubs with apparatus to provide for all physical needs. This use of these facilities in the geodesic dome health club will be permitted for all colonists at no cost.

Along the sides of the interior of the space travel tubes are bike lanes for the use of pedestrians, bikers, and joggers. These are designed to provide enough room for exercise on your way to work or anywhere. Also, the scenic beauty of the surrounding foliage makes the exercise more pleasant.

To showcase athletic abilities, sports stadiums are to be built. In meets or games, the crowd is allowed to come down and compete with the contestants.

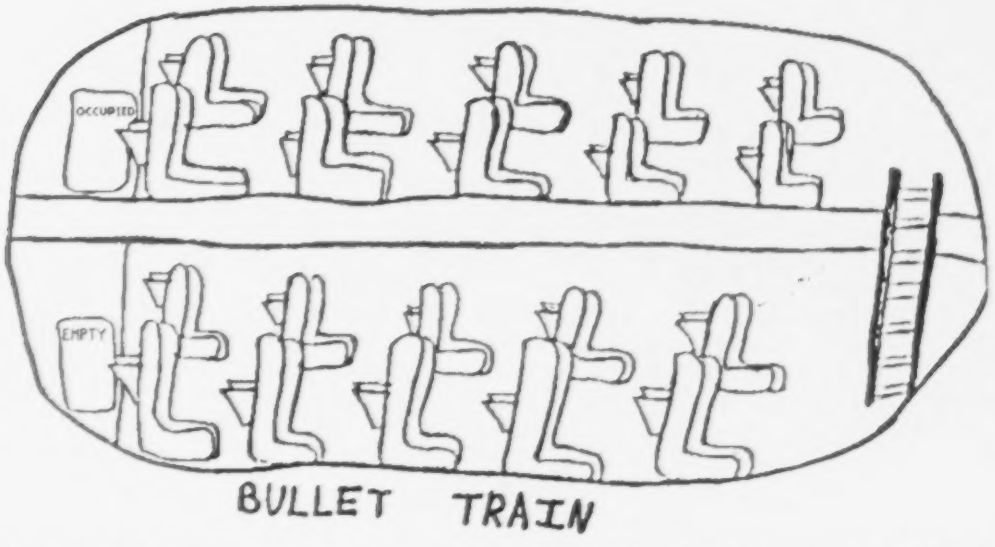
There are two types of gymnasiums, those with gravity and those without. The latter can be used for long jump, pole vault, etc. The gravity gymnasium can be used in ways we are familiar with from earth. We will have theatres for plays and musical entertainment, also movies will be shown there. There will be special recreation rooms that have pool tables, pinball and video games, plus assorted other space games and thinking games.

Transportation and Communication

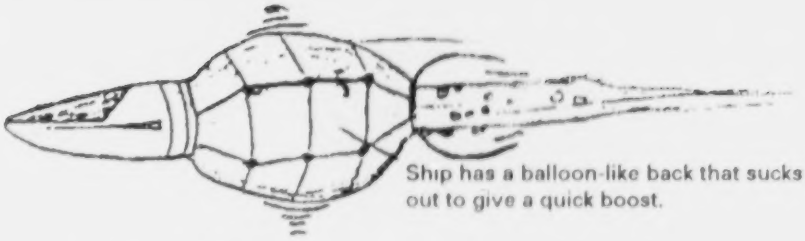
In the transportation of all people on the planet, virtually all vehicles are amphibious. The vehicles can be used mostly for land and sea. A few can be used for land, sea and air, but not many are needed for all three.

For communication by individuals on our planet we have developed a computer watch which allows you to communicate. The watch is called a Kronom KD-2 and one will be issued to all individuals in a family. It has many features which may be quite useful on our planet.

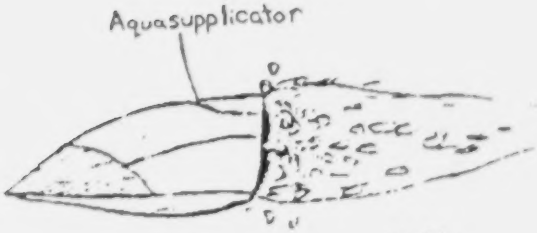
We will continue to use our communication system from the Apogee and have the ability to communicate between our three colonies, anywhere on the planet, back to earth and reaching out to possible communication in the surrounding galaxies.



This bullet train is run on computers and needs no driver. It can hold up to forty passengers. Each seat has a pouch and a foldown tray. It is air conditioned and each seat has the capability to stop the train. On top there are sunroofs to let in light. On the bottom each seat has their own light. Also, lavatories are located in the back.

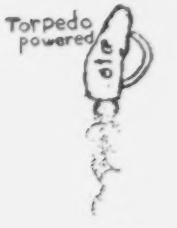


Ship has a balloon-like back that sucks in, and bursts out to give a quick boost.

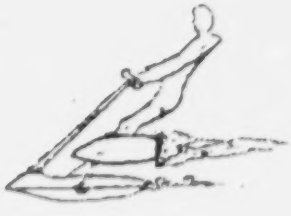


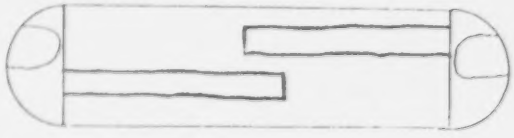
underwater MMV

Aquasupplicator: is a machine which supplies oxygen and fuel from ordinary water. First it separates salt and other minerals from the hydrogen and oxygen, then it splits the atoms of each, reproducing it. Then again the machine splits hydrogen and oxygen. A tube blows oxygen into the control room of the ship, and hydrogen into the fuel tank, since it makes good fuel. It releases the other minerals and salt making the ship powered and ventilated all the time. These aquasupplicators will be in almost everything people are already reproducing by splitting atoms of cells, but this will be much more efficient and fast. This may change the compound of the water, making it very abnormal, but only in about one cillion years.

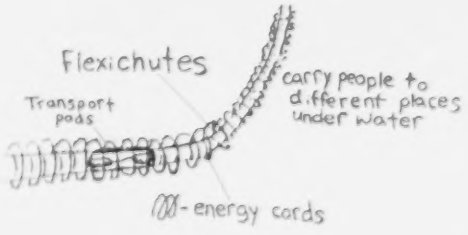


Hover craft

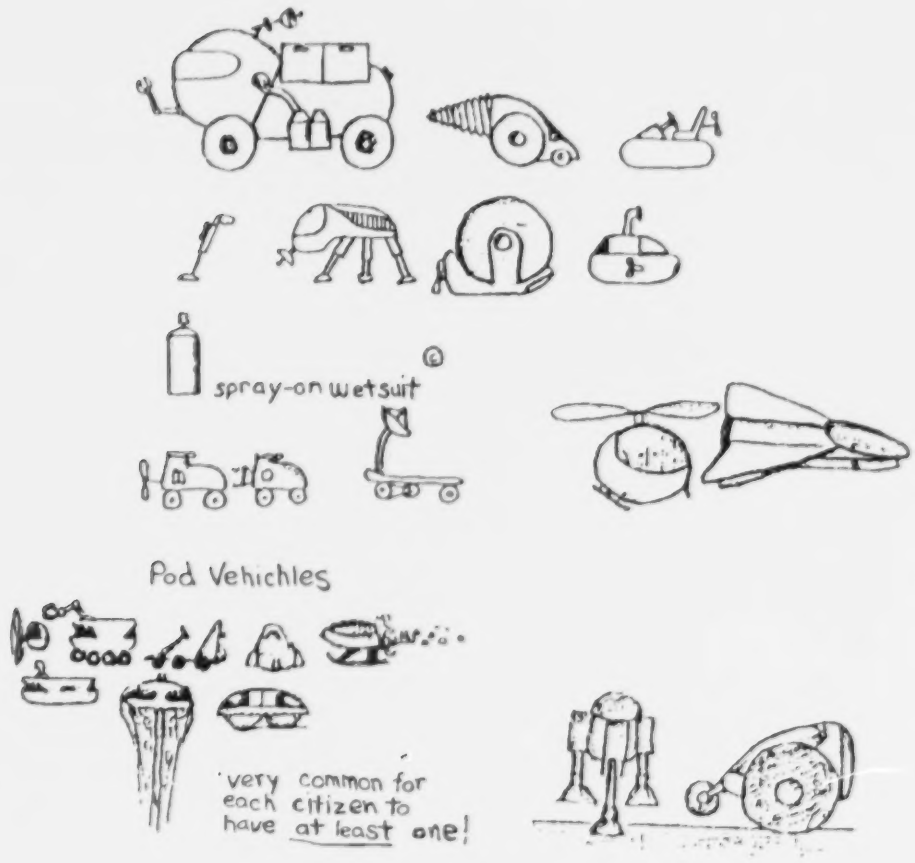


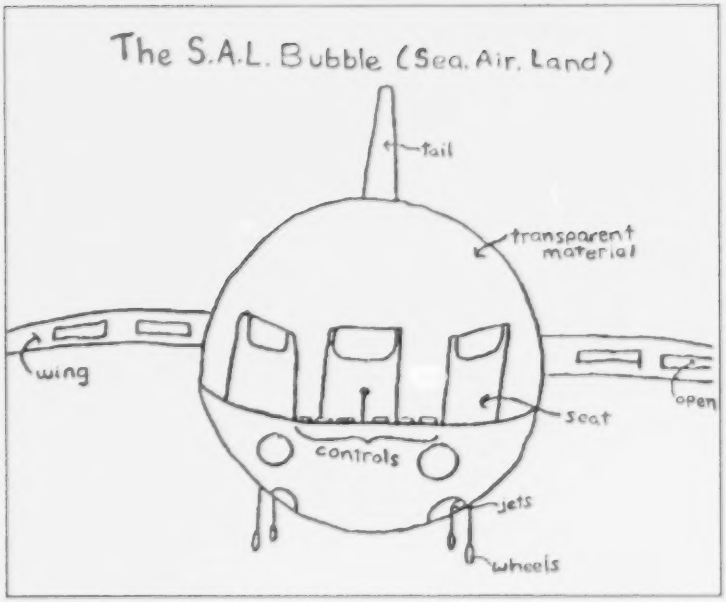


The transport pod is used for public transportation. It travels through "Flexi-Chutes" which lead to stations. The whole system is similar to a subway or monorail system. The chutes are covered with energy cords which give the pods and chutes energy.



Land Transportation and Exploration Vehicles



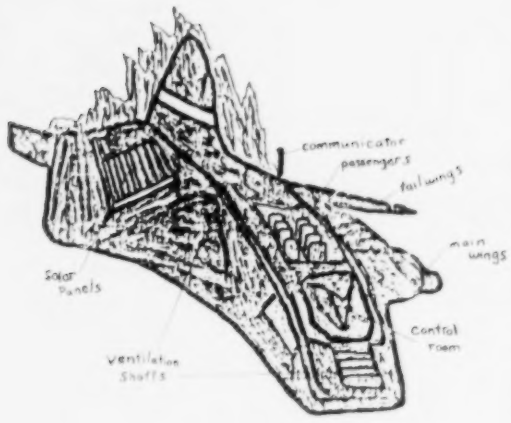


Transportation Vehicles

The S.A.L. Bubble is a vehicle for the air, sea, and land. It can fly, propel itself underwater, and go about like a car. Three people can be seated in a S.A.L. When in the air, air flows through openings in the wings and is forced out the back of the wings causing the S.A.L. to move forward.

In water, the S.A.L. moves through the water similarly to how it flies. Instead of air, water is forced through the wings.

On land the S.A.L. runs on air, which is forced through the wings. The S.A.L. can be steered by jets that are all around the vehicle. S.A.L. is made of clear, plastic-like material. It is pressurized and filled with oxygen.



The S.A.L.S.A.V.
Sea Air Land
Super Aeronautical Vehicle

The Salsav

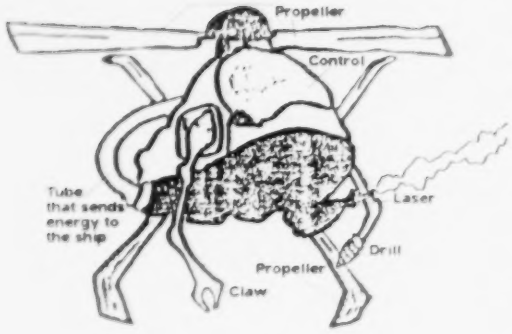
This is a shuttle designed for getting from one colony to another. When on land the Salsav skims over the ground, making it the fastest way of small transportation.

When the Salsav is in the air, it flies with a thermal nuclear engine. This will make it the fastest shuttle on our planet.

When the Salsav is in the sea it usually dives into the water from the air. The ventilation shafts close and it is moved by retro thrusters in the back that convert water into a small explosion. The explosion propels the ship to go approximately thirty knots per hour.

The Salsav can carry fifty people with ten first class seats where you can look up through a fiberglass window.

This ship requires a navigator, captain, and co-pilot. There will be two or more of these travel ships that operate on a schedule of every thirty to forty-five minutes.



SEARCHER
A Search and Rescue Vehicle

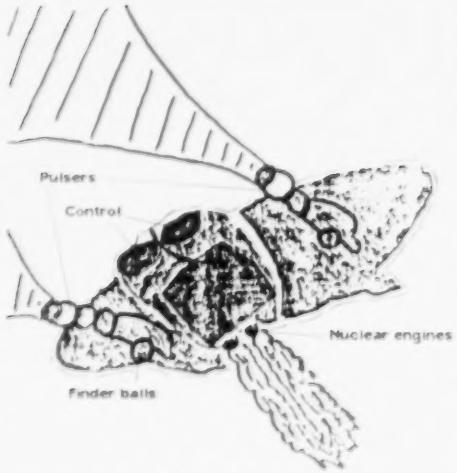
Uses of the Apogee

After we have built our permanent colonies we have to decide on uses for our traveling ship, the Apogee. We made transporters out of the Cataclysm and other parts of the ship. We used the fuel tanks and the living quarters to make into housing developments. The payload of the Apogee will not fill the needs of three generations of people, but it will be enough to enable us to survive until our Manufacturing plants and agricultural processes are in operation.

One of the two transport ships will be a scientific material finder and the other will be affixed as a satellite to use for emergencies. After these ships are made we will take materiels found on the planet and remaining materials from the Apogee and make another space cruiser that can travel farther and faster.

The Searcher

The Searcher is a vehicle that is equipped with a robot arm and drill. It also has a fusion laser. This is to get rid of any substance that might trap people. It will have many other uses and will travel at a maximum of forty kilometers per hour.



The Pulsator
Seeks materials and resources for use

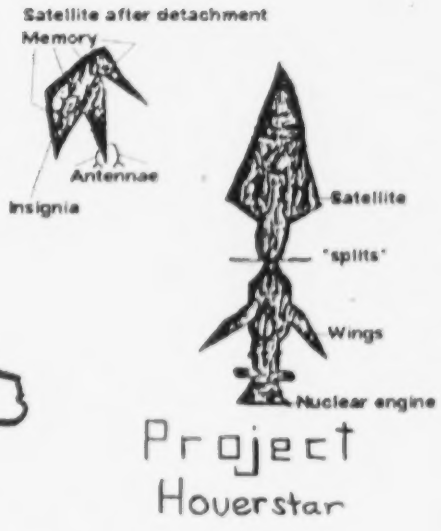
The Pulsator

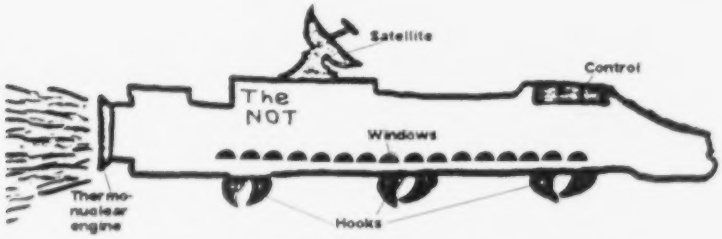
The Pulsator is designed to go on land, and water to find resources and materials for use in industry and manufacturing.

The Pulsator emits electronic beams of light that actually go into the substance and the light beams come back to the ship. It is like radar, it hits the object, immediately scans it, then comes back to the ship and tells where the resources are plentiful. It also uses finder balls, which are sent across the planet to retrieve a certain substance. It sends a beam of pure energy into the object turning it into a beam of light that is immediately shot back to the ball. The ball then goes back to the ship and transforms the material back into its original form. It is similar to a teleporter. The Pulsator uses a nuclear engine and can travel up to eighty kilometers per hour.

Project Hoverstar

Project Hoverstar is going to be the first satellite orbiting the planet. It starts off like a rocket, when it gets to 500 feet above the atmosphere it splits. The rocket is then electronically controlled and returned to the launch site. The satellite then continues for about 1,000 feet and then flips around and opens. It can take communications, radio signals, and television beams.





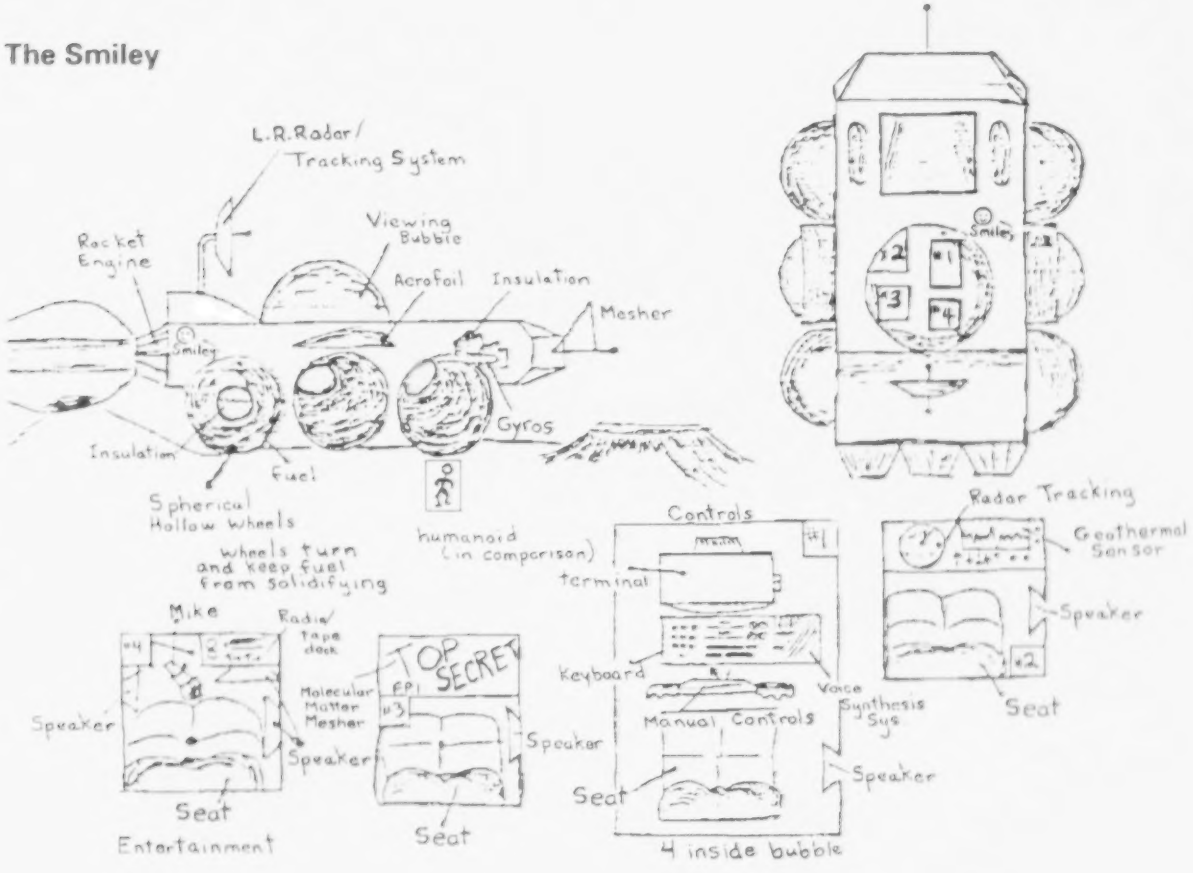
The N.O.T. (Nuclear Operated Transport)

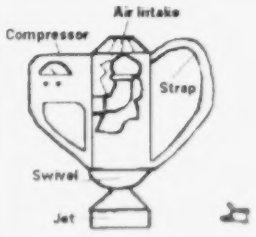
The N.O.T.

The N.O.T. is a large transport system that can go from the land to the air. It can take 250 people and has a thermo-nuclear engine.

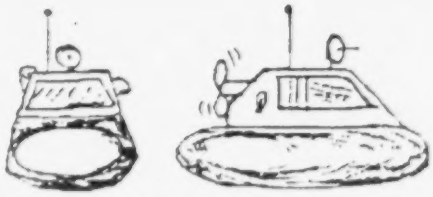
Passengers are not allowed to get out of their seats and they must wear seat belts at all times because it travels at 350 kilometers per hour.

The Smiley

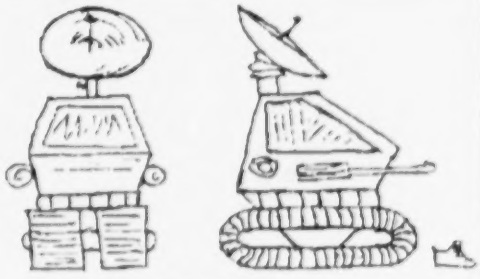




JET PACK (MMU)

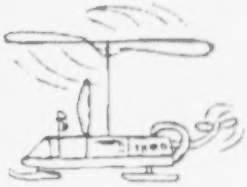


HOVER CAR



TRAK MACHINE

These vehicles are used for both recreation and transportation.

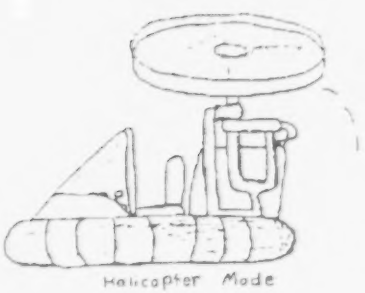


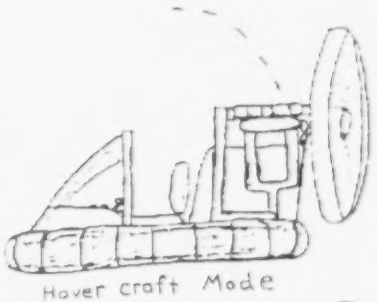
GYROCOPTER

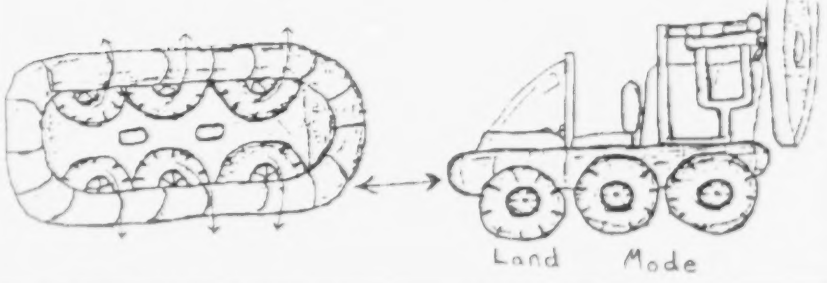
SKIDDADDLEBOARD

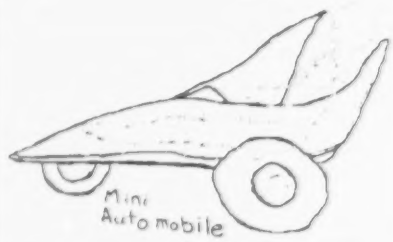
WEATHER BLIMP

BIG WHEEL





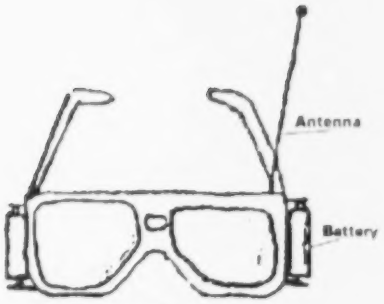




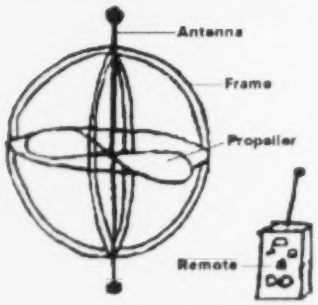
PUBLIC TRANSPORTATION

Cannons shoot capsules carrying people to another colony. Computers calculate exactly where to point the cannons to make the capsules land at the base. Capsule's landing is cushioned by several yards of water, then the people leave the capsule.

Technical Illustration

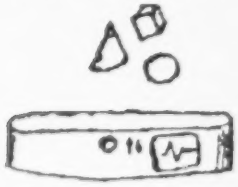


T.V. / SUNGLASSES
ultrathin fibreoptic lenses
also serve as TV tube



GYROCOPTER
same as a gyro except that the wheel
is replaced by a propeller

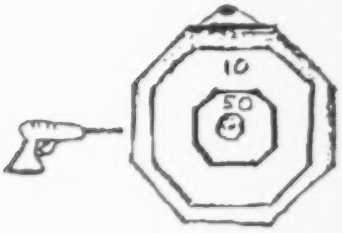
SUPER BEANIE
solar powered, light weight
helicopter device



HOLOGRAM PROJECTOR

BOUNCY SHOES
especially good
for basketball

ROLLER SKATES TO ICE SKATES
"at the touch of a button"

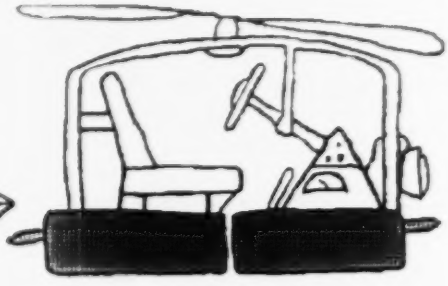


LASER " DART" BOARD

FLYER BACKPACK

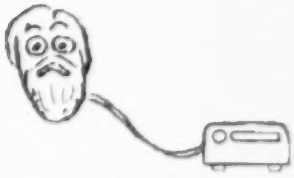
HOLOGRAPHIC T.V.
broadcasts a full color, 3-D picture

BRIEF-COPTER
compact, light-weight, fold-up copter

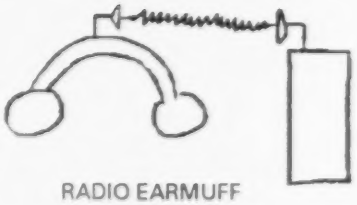


Check for our whole line of
brief case products

DRINK SERVER
Serves drinks and much, much more



SMELL RADIO
broadcasts fresh smelling music



RADIO EARMUFF
1. receivers in ears
2. radar with separate channels

PORTA POTTY
Conveniently folds into a
nice shady safari hat

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Flying High

A Space Science Curriculum Unit

By
Paul Robinson
Edison Computech High School

Purpose and Overview

While few schools can muster the time and resources to select, design, build and launch an actual student experiment aboard the space shuttle, almost any can simulate the experience. This unit enables a far greater number of students to experience the process and participate in this very worthwhile activity. Designed for secondary students, this unit consists of three lessons. Each lesson could entail several days of class time depending on the level and interest of students.

Goals

1. To foster interest in and appreciation of the value of space science
2. To understand the value of experimentation in space
3. To understand what is meant by zero-g
4. To understand the operation on familiar objects in space
5. To experience the brainstorming technique utilized in research design
6. To appreciate the creativity required to actually launch an experiment
7. To acquire knowledge of the Get Away Special program

Lesson 1: Contrasting Everyday Experiences in Zero-G

Objective:

To generate interest in the microgravity environment of the space shuttle.

Procedure:

This objective is readily accomplished by showing the NASA videotape, *Toys in Space*. The operation of several toys can be contrasted to their behavior here on earth. Toys demonstrated include a slinky, 'Rat Stuff,' Wheelo, 'Snoopy' top, gyroscope, magnetic marbles, wind-up car, jacks, paddle ball, and a yo-yo, as well as a paper airplane.

Ask students to predict the behavior of these toys in space. You might have them write their predictions down, show the videotape, and then discuss any discrepancies. Extend the activity by asking students to write why the toys behaved differently than they had predicted.

Materials:

Toys in Space; videotape available from NASA audio visual centers.

Follow-Up Questions:

1. What difficulties would an astronaut encounter pouring a glass of soda pop from a can?

   Answer: It would not pour; the soda would have to be either squeezed or shaken out of the can – a messy process!

2. Would bubbles in a glass of soda pop rise?

   Answer: No; in a zero-g environment, the bubbles do not weigh less than the surrounding soda. The bubbles would remain put.

3. What athletic games would be possible in a zero-g space environment? How would they have to be modified?

   Answer: Any games involving projectiles like baseball and volleyball would require major modification. Others like basketball, might be modified so that in some ways they resemble hockey. Non-athletic games such as a hula-hoop and tetherball might operate nearly as they do on earth.

4. Would a match lit aboard the shuttle remain lit?

   Answer: No, not unless the air was being circulated. Since warm air generated by the match is not lighter than the surrounding cooler air, it extinguishes the match for lack of oxygen.

5. An astronaut forgets to turn off a flashlight floating in the shuttle. She returns to find the plastic case of the flashlight has melted. Why?

   Answer: The light bulb, unlike a match which requires a constant oxygen source to remain lit, generates heat and warms the flashlight. The flashlight heats the surrounding air. Because the warm air is not lighter than the surrounding cooler air, it does not rise, allowing cooler air to replace it (forming a convection current). The plastic case is not cooled, therefore, it heats up and melts.

Suggested Resources:

Code 740, Goddard Space Flight Center, Greenbelt, MD 20771. Call (301) 286-6760 for information.

Get Away Special Experimenter's Symposium; NASA Conference publication 2401. This 140 page booklet consists of the conference proceedings held at Goddard Space Flight Center, October 8-9, 1985. Detailed descriptions of pre and post flight experiences.

Get Away Special Experimenter's Symposium; NASA Conference publication 2438. This 240 page booklet consists of the conference proceedings held at Goddard Space Flight Center, October 7-8, 1986. Detailed descriptions of pre and post flight experiences.

Orbiter – Space Shuttle Simulation, Spectrum HoloByte, Inc., 1050 Walnut, Suite 325, Boulder, CO 80302. (303) 443-0191. This simulation for the Macintosh computer graphically illustrates the computational power of the computer and the complexity of modern space flight.

Toys in Space; Results of the Space Shuttle Mission STS-51D; this 20-page teacher's guide accompanies the *Toys in Space* videotape. Government Printing Office #1987-761-013/60082.

Lesson 2: Weightlessness

Objective:

To understand the term 'Zero-g,' and to be able to distinguish between true and apparent weightlessness.

Explanation:

'Zero-g,' or 'weightlessness,' is commonly used to describe the situation where objects (usually people!) float while in free fall for the apparent lack of weight. The term 'zero-g' is often used to mean 'no gravity' or absence of gravity. Many people think the reason for this is the shuttle is so high above the earth's surface as to be beyond the pull of earth's gravity. This is quite wrong; at a distance of 100 miles (a typical orbital distance above the earth's surface), the pull of gravity is about 95% what it is on the earth's surface. Most of the time the only force acting on the shuttle *is* gravity. In fact, if it weren't pulling down on the shuttle, it would not remain in orbit and fly off in a straight line path away from the earth in much the same way a rock swung around on a string behaves when you let go of it.

Then why do the astronauts float around inside the shuttle – 'weightless?' Consider yourself standing in an elevator. You feel your normal weight when the elevator is motionless or moving at a constant speed. You feel greater than your normal weight if the elevator accelerates upward; less if it accelerates downward. You feel weightless is you loose your support in free fall.

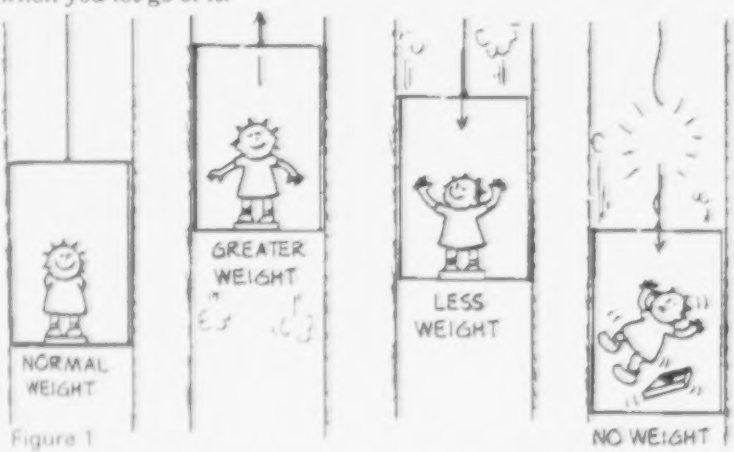


Figure 1

If you define weight as gravitational force acting on an object, then you still have weight whether or not your are falling freely. Astronauts in earth orbit who float freely inside their capsules are still being pulled by gravity and therefore have weight. But you in the falling elevator and the astronauts in the 'falling' satellites don't feel the usual effects of weight. You feel weightless. That is, your insides are no longer supported by your legs and pelvic region. Your organs respond as though gravity were absent. You are in a state of *apparent weightlessness*.

To be truly weightless, you would have to be far out in space – well away from the earth and other attracting stars and planets – where gravitational forces are negligible. In this truly weightless condition, you would drift in a straight line path rather than in the curved path of an orbit.

In a more practical sense, we define the weight of an object as the force it exerts against a supporting floor (or weighing scales). According to this definition, you are as heavy as you feel. The condition of weightlessness is then not the absence of gravity. It is the absence of a support force. Astronauts in orbit are without a support force and are in a sustained state of weightlessness.

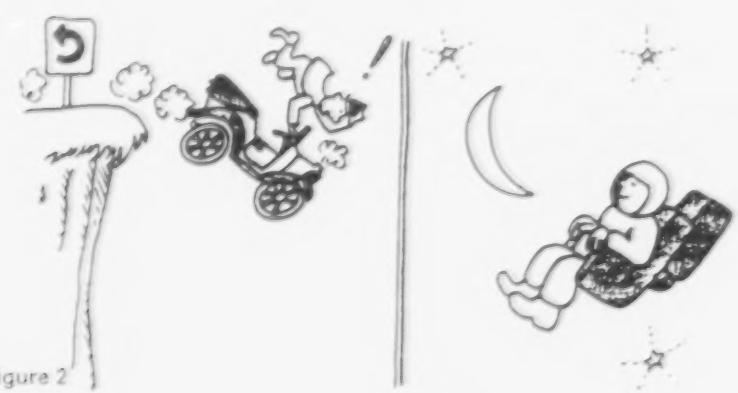
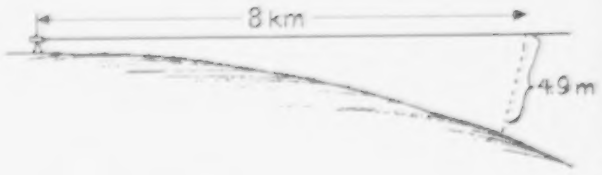


Figure 2

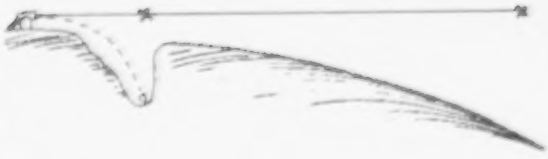
How to Derive Orbital Velocity:

Sketch the first diagram of figure 3 on the board.

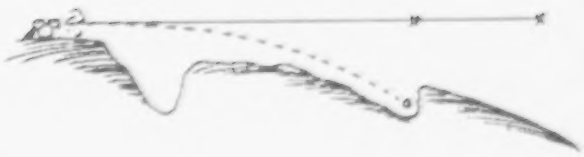
Pretend to place a laser on a 1-meter high tripod and aim it over a desert floor. The beam is a straight, but the desert floor curves 4.9 meters over a 8000-meter (8km) tangent, as shown in the sketch below (not to scale!).



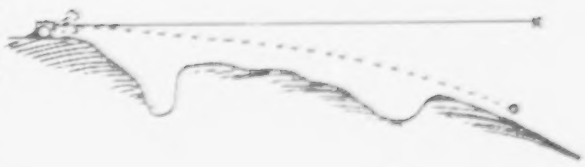
After you have drawn this figure on the chalkboard, replace the laser with a super canon positioned so it points along the laser line. Consider a cannonball fired fast enough so that in 1 second it travels 3km along the laser line, which you indicate with an 'X,' you say, because it falls beneath the 'X' because of gravity. How far? 4.9 meters, if the sand weren't in the way. If the cannonball is not to hit the ground, we'd have to dig a trench first, as you show on your sketch, which now looks like this:



Continue by considering a greater muzzle velocity – great enough so that the cannonball travels 5 km in 1 second. Then repeat the previous line of reasoning, again having to dig a trench. Your sketch should now look like this:



Continue by considering a still greater muzzle velocity – great enough so that the cannonball travels 8 km in 1 second. (Don't state that the velocity is 8km/s here, or was 5km/s or 3km/s in the previous examples, as you will diminish the punch line and your students' chance to make the mental jump by themselves.) Repeat the previous reasoning, and note that this time you don't have to dig a trench! After a pause, and with a tone of importance, ask the class what speed the cannonball must have in order to orbit the earth. Done properly, you will have led the class, without equations or algebra, into a 'derivation' of the orbital speed about the earth!



You may wish to acknowledge that gravitational force is less on satellites in higher orbits, so high-flying satellites need not go so fast.

Figure 3

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Procedure:

Have students perform a weightlessness activity from a book such as the *Conceptual Physics Laboratory Manual* (Addison-Wesley). If this is not practical, provide a demonstration. Present the derivation of orbital speed 8 km/s for low earth orbits (between 50 and 150 miles). Then show the movie *Zero-g*. Follow-up by forming student groups to answer the Follow-Up Questions. Have each student group present the answer to one of the questions to the rest of the class.

Materials:

Zero-g; available from NASA audio visual centers.

Follow-Up Questions:

1. What falls with greater acceleration – a heavy rock or a light rock?

   Answer: Neglecting air friction, all objects, regardless of their mass, fall 4.9 meters in one second. Drop one brick or ten, they hit the ground at the same time. On the moon where there is no atmosphere, both a hammer and a feather hit the ground at the same time. For students a bit perplexed by this, you might want to state Newton's Second Law, a=F/m. The heavier bricks are pulled by gravity ten times harder (10F), but also have 10 times the inertia (10m) – or tendency to remain at rest. So the greater downward pull is compensated by the greater tendency to stay put! Thus, the acceleration for each is the same:

   $$a = F/m$$
   $$= 10F/10m$$
   $$= a$$
   $$= g$$

   (g = the acceleration of gravity, or 9.8 meters/second each second).

2. Is the pull of gravity on an orbiting shuttle near zero?

   Answer: No; the pull of gravity is about 95% what it is on the earth's surface.

3. Once a satellite is in orbit, how much force is required to keep it in orbit?

   Answer: None other than gravity.

4. Would a satellite remain in orbit if the earth's gravitational pull on it were suddenly reduced to zero?

   Answer: No; the satellite would fly off in a straight line tangent to the earth's radius.

5. Is the shuttle in free fall around the earth when it's in orbit?

   Answer: Yes.

6. Are astronauts in the shuttle in free fall around the earth when it's in orbit?

   Answer: Yes; the shuttle and the astronauts fall together.

7. Is it correct to say the astronauts and the shuttle are actually falling? If so, why aren't they getting any closer to the earth's surface?

   Answer: Both the astronauts and the shuttle are actually falling – not into, but around the earth. Falling is a relative term. Normally we say something is falling because it is getting closer to the floor. However, we could also say it's falling if it's getting further from the ceiling. In this case, the shuttle and the astronauts are not getting any closer to the earth's surface (the floor), but are falling from the straight line (the ceiling) they would go if gravity weren't pulling down on them.

8. How fast does a satellite have to go to remain in orbit?

   Answer: For low earth orbit, about 8km/s tangential (sideways) to the earth's radius.

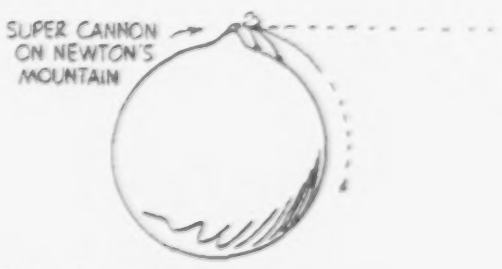

Figure 4

Lesson 3: Designing an Experiment Aboard the Shuttle

Objective:

To introduce students to the GAS concept and acquaint them with a shuttle environment.

Procedure:

To motivate your student groups to engage in brainstorming session and to propose experiments to be flown aboard a shuttle, devise a scenario to present to students. One scenario is that the government has announced it will provide full college scholarships to the student with the best proposal. Another scenario might be that your group owns a venture capital company which is trying to get a jump on the competition by demonstrating the feasibility of an idea or process. Another scenario might be that the group with the best proposal will be flown to Cape Kennedy to see a shuttle launch. It's important not to erect too many barriers that limit the students' creativity. Have students operate as if cost, time, and effort are in infinite supply. A group of students and teachers from the University of Utah actually launched (using a spring) a satellite from a GAS cannister as a result of their participation in designing an experiment for a shuttle.

Information about the GAS concept and the Shuttle

The teacher can supply students with the following summary about the actual GAS cannister and the shuttle environment. This can provide background to make the students' proposals more realistic.

The Get Away Special, or GAS, program was established by NASA so that private industry, individuals, or groups – such as schools – can design, build, and run their own experiments aboard a space shuttle. GAS cannisters are bolted to the side of the cargo bay. Before students can devise experiments of their own, they need to know a few of the guidelines. Following are some of the guidelines to consider in designing an experiment:

Experiments must be entirely self-contained in a cylindrical space of 5 cubic feet, 28 inches high by 20 inch diameter and weigh no more than 200 pounds. They must be powered by batteries using the experimenter's battery pack. At the experimenter's option a baroswitch can activate one of three relays at approximately 70,000 feet during ascent. The GAS containers can be purged with dry nitrogen or dry air as specified by the experimenter. The container is capable of maintaining about one atmosphere of pressure at all times; evacuation during ascent and repressurization during reentry, or being evacuated before launch is possible. The cannister can be outfitted with a motorized lid that can be opened and closed. The experiment must be self-operated or computer-controlled as an astronaut will only throw three switches: on-off, verify command sent/received, and relay contacts. The cannister may be subjected to temperature extremes between –160 degrees Celsius during orbit and 105 degrees Celsius post landing. Cannisters come with or without an insulating endcap. The experimenter must design ways to heat or maintain specific temperature. Typically, the heat generated by the battery pack is sufficient to keep the cannister between 10 and 20 degrees Celsius. Normally, the shuttle is oriented in an earth-viewing attitude. Safety is a prime consideration for all experiments. The final package must pass a rigorous set of safety inspections, including bench testing 6 months before launch. The fully assembled, tested and safety checked experimental package must be delivered about 90 days before the scheduled launch where it undergoes final inspection. It is loaded aboard the shuttle about two months before launch. Missions usually last five to seven days.

See figure #5.

Partial list of proposed or actual GAS experiments

- Crystal growth of artificial snow; observe the formation of ice crystals
- Reaction of yeast to the vacuum and weightlessness of space
- Growth of lettuce seeds
- Observation of genetic changes in barley seeds
- Growth of Brine shrimp in a 72-hour period
- Germination of turnip seeds
- Operation of liquid laser
- Planaria regeneration
- Effectiveness of antibiotics on bacteria in space
- Observation of the growth of soil mold
- Effects space conditions, such as cosmic rays, have on the performance and/or failure rate of DRAM computer chips

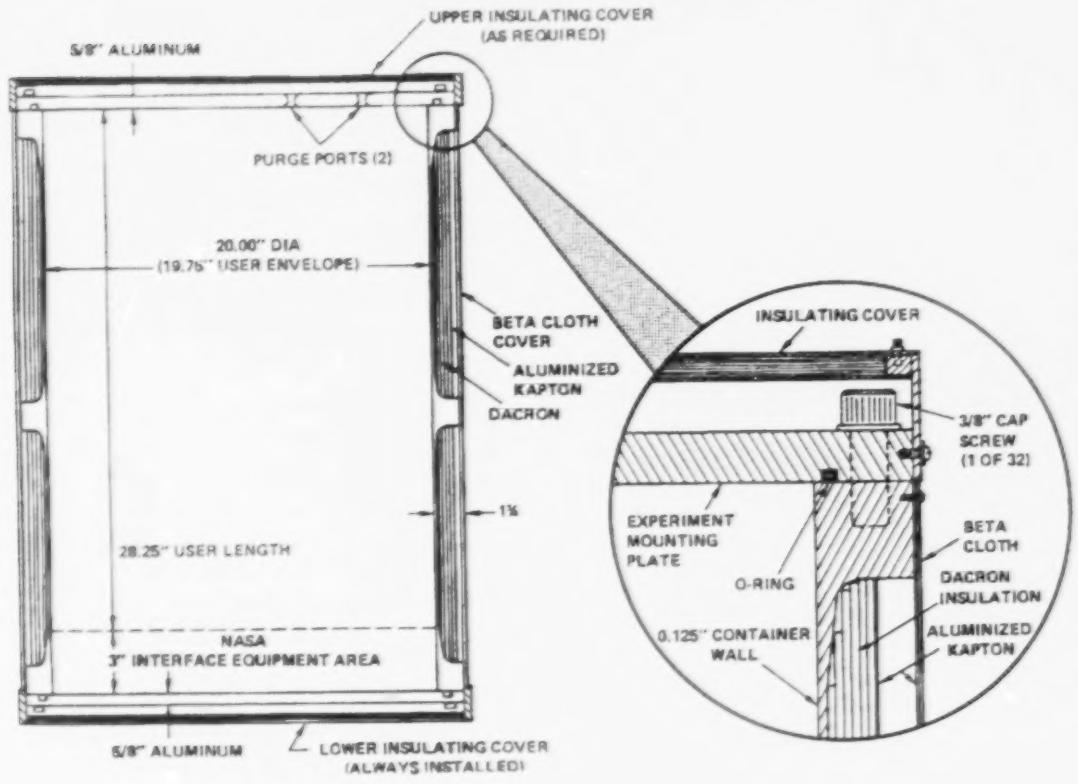

Figure 5

- Effects of zero-g on the diapause of gypsy moth eggs
- Phototropic effects on seeds in space
- Study of the vibrations of the shuttle using a piezo-electric film to record what happens when the cargo bay doors are opening and closing
- Effects of zero-g on the ability of pillobolus to aim its spore towards a light source (the sun)

Experimental proposals should include:

1. Purpose
2. Expected Results
3. Design
4. Materials needed
5. How data will be collected and stored
6. Electrical power estimates
7. Weight estimates
8. Safety considerations

Have student teams submit their proposals in written form. They should include as many diagrams and sketches as possible. Then have a team leader present their proposal to the rest of the class. Have students vote as to the best proposal or have the school's science faculty rank them.

Going Further

If one or more of your groups submits a promising proposal, the teacher should encourage them to participate in the Space Shuttle Involvement Project (SSIP). Unrelated to the GAS program, this annual competition for students grades 7-12 is sponsored by the National Science Teachers Associations (NSTA) and NASA. Student winners receive opportunities to visit NASA facilities and interact with scientists and engineers. Additional information is available from NSTA, 1742 Connecticut Ave., NW, Washington, D.C., 20009.

Annotated Bibliography

Hewitt, Paul G. *Conceptual Physics.* Addison-Wesley Publishing Co., Menlo Park, 1987.
Written to make physics understandable – even appealing – to the non-science student. An excellent resource for the non-physics teacher.

Robinson, Paul. *Conceptual Physics Laboratory Manual.* Addison-Wesley Publishing Co., Menlo Park, 1987.
This companion lab manual to *Conceptual Physics* contains 98 activities, including 'Apparent Weightlessness,' for both the science and non-science student.

Zero-g. NASA.
An excellent film which explains the notion of 'zero-g' in terms of basic physics principles. Newton's laws of motion are presented in a down to earth manner aboard Skylab. Available from your local NASA audio visual center.

A Teacher's Companion to the Space Station. Published by Martin Marietta, P.O. Box 29304, New Orleans, LA 70189.
A multi-disciplinary resource guide with suggested activities and lesson plans for elementary and secondary students.

Space Telescope.
A 64 page color pamphlet detailing what some describe as "the most important scientific instrument ever flown."

Moels, Kerry & G. Kennedy. The Space *Shuttle Operator's Manual.* Ballantine Books, NY.
This nifty book would be the first thing you'd buy if you were a Russian spy! Prepared with the assistance of the NASA Directorate for Crew Training, it describes everything from emergency procedures to how to wash your hands.

Apollo-Suyuz Pamphlet No. 7. Biology in Zero-G. NASA publication EP-139.
Describes the biological experiments carried out by the Apollo-Suyuz crews in 1975. Appropriate for advanced biology students.

Experimenter handbook. NASA.
This 91-page handbook provides information on NASA systems and procedures relating to the preparation and installation of a GAS cannister aboard a space shuttle. Single copies available from GAS Technical Liaison Officer, Code 740, Goddard Space Flight Center, Greenbelt, MD 20771. Call (301) 286-6760 for information.

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Orbiter – Space Shuttle Simulation, Spectrum HoloByte, Inc., 1050 Walnut, Suite 325, Boulder, CO 80302. (303) 443-0191.
This simulation for the Macintosh computer graphically illustrates the computational power of the computer and the complexity of modern space flight.

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Mississippi	NASA Natl. Space Technologies Lab Building 1200 NSTL, MS 39529	NASA Natl. Space Technologies Lab Attn: Teacher Resource Center Building 1200 NSTL, MS 39529 (601) 688-3338

Search for Truth

by Jane Schaffer

Suggested Resources

1. *Introduction to the Humanities: Painting, Sculpture, Architecture, Music and Literature.* Doris Van De Bogart; Barnes and Noble.
2. *A Tribute to Anne Frank.* Steenmeijer, Editor in collaboration with Otto Frank. Doubleday and Co., 1971. Many Pictures.
3. *Man and his Values: An Inquiry into Good and Evil.* The Center for Humanities , Inc., White Plains, NY 10603. Sound-Slide kit.
4. *Primer of Freudian Psychology.* Hill; Mentor.
5. *Primer of Jungian Psychology.* Hill; Mentor.

Sample Time Line for "Search for Truth"

TEACHER	STUDENT
Day 1 Introduce unit Talk about different books, spending one minute per book *Old Man and the Sea* *Intruder in the Dust* *Lord of the Flies* *Heart of Darkness* *Something Wicked This Way Comes* *Diary of Anne Frank* *The Odyssey*	Select first and second choices of books to read
Day 2 Give each group its assignments for library research:	
Old Man and the Sea:	• Read about bullfighting and Rafael Gomez (El Gallo) • Draw map of Cuba • Read about life in fishing villages • Read about fish – marlin, shark • Study fish symbolism • Use Hemingway's biographical sketch
Intruder in the Dust:	• Read biographical sketch on Faulkner • Read about black-white contact in the South in the 1920's until now • Study Jim Crow laws • Draw a map of the South and a map of the Confederacy • Read about slavery
Lord of the Flies:	• Study biographical sketch on Golding • Read about jungles • Read about British public schools • Read Jung's philosophy of the shadow and archetypes • See sound-slide show on good and evil, *Man and His Values* • Read Genesis and the Garden of Eden, and the Fall of Man Section of the Bible • Read about Beelzebub

Heart of Darkness:
- Draw freehand map of Africa, label the cities and rivers with both their African and English names
- Read biographical sketch of Conrad
- See sound-slide show *Man and His Values*
- Read about British colonial history in Africa
- Read about ivory and the cost of gathering it
- Read about slavery

Something Wicked This Way Comes:
- Read biographical sketch on Bradbury
- Read about tattoos and carnivals
- Read about lightning rods
- Read about the nightshade family of plants
- Find out about Chopin's Funeral March and "I Heard the Bells on Christmas Day"
- Read Norman Cousins' book about his illness

Diary of Anne Frank:
- Read about Nazi Germany and the concentration camps
- Find art drawn by children in the camp *(I Never Saw Another Butterfly?)*
- Read biographical information about Anne Frank
- Read about the Franks' house in Amsterdam
- Keep a diary about your four weeks while reading Anne Franks' diary

The Odyssey:
- Observe Greek art
- Draw a map of Odysseus' travels; label the order of the events in the journey
- Review the gods and goddesses
- Read about predestination and Calvin
- Read about the Greek religion and world religions in general
- Read about the Classical Age of Greece
- Read about Greek music and musical instruments
- Read about the Olympic Games

Day 3-7 — Work in the library on the assignments listed above. Read and take notes.

Participate in these activities after you have completed the assignments:
1. Discuss the book read in small groups;
2. Write your own essay question as a home writing assignment;
3. Write a draft of the essay and work in a group to revise your essay for the final draft;
4. Write the final essay. This should focus a "Search for Truth" – how you interpret and understand it. This should integrate the readings and should evidence a synthesis of the material.

Student-Created Questions on their books:

1. In the story, *Old Man and the Sea*, readers see either a triumph or a tragedy. A triumph can be seen when the old man catches the great fish. A tragedy can be seen when the sharks eat the fish before the old man can get it back to port. Even though he loses the fish, some still think it wasn't a wasted effort. Do you see this as a triumph or a tragedy?

2. In the story, *Old Man and the Sea*, is the Old Man just an old man, or does he represent something else? Try to define him as a symbol. Does the marlin he catches represent a fish or something else? Relate the struggle of the fish and the Old Man to life.

3. In *Lord of the Flies*, Golding describes "The Fall of Man" through the eyes of children stranded on an uninhabited island. We see the children as innocent boys searching for a way to survive, but the youngsters blindly let the evil escape from their minds, triggering a regression to primitive behavior – the boys begin to hunt like savages and even fall prey to homicide. Describe and/or discuss reasons why this society lost its search for truth and reverted to a primitive culture. Include passages from the book, quotes, personal knowledge, history, psychology, or other literature you've read.

4. Discuss the comparison and contrast between civilized man in a society and primitive behavior away from civilization. In good and evil, goodness nurtures and protects human life and growth, while evil is the destruction of human life, ideas, and growth. Searching for freedom and the truth within themselves is the reality of the children's life on the island.

5. Using *Something Wicked This Way Comes* as a reference, describe two or more people and their search for truth in their individual dilemmas.

6. Analyze the music used in *Something Wicked This Way Comes* and discuss how it enhances themes in this literary work.

7. Compare the ways in which people are lured into evil by the apparent good that comes from it or by their efforts to improve themselves. Use *Something Wicked This Way Comes* as a reference.

8. In *Something Wicked This Way Comes*, the conflict arises when the older generation yearns to be young once again. The passing of years that brings wrinkles and frequent trips to the medicine cabinet also tends to have a permanent effect on our outlook on life. We view it with bitterness and regret. With Charles and Will Halloway, the age gap becomes a problem. How did this affect their relationship and the story line itself?

9. *The Odyssey* is the story of one man's struggle to return to his home. During the course of this struggle, Odysseus meets many gods and goddesses. It has been said that people use myths or make up gods for things that they cannot explain. Write an essay comparing the gods and their situations with what you think they stand for and their relevance to Odysseus' trip home.

10. A quest is defined as the act of seeking something – a search. In *The Odyssey*, Odysseus goes through a trial by fire. A warrior born, he is governed by gods and goddesses. He prevails by making it home against a most powerful god's curse. Why was Odysseus so oblivious to everything except making it to his kingdom and family? Write and essay explaining what gives some men courage and stamina to go on where other mortal men fail.

11. In the novel, *Intruder in the Dust*, we recognize Chick as an adolescent who feels that he owes Lucas his life, and he must return the favor. Did Charles actually feel indebted to Lucas – the old black man who was socially and racially outcast – or did he just want to be adventurous and do something special that – in that era – no other teenager would ever do? Describe and support your analysis in a well-organized essay.

Search for Truth

by Kim Boehm

We are invariably looking for some way to bridge the gap that exists between the young and old in order to attain a peaceful, understanding relationship. In *Something Wicked This Way Comes*, Charles Halloway, the elderly gentleman, is continually plagued by his age. He feels distant and apart from his son Will, who he feels harbors the energy and spirit of the wind. When Cooger and Dark come to town, they bring with them a carousel that offers an answer to the gap. Charles Halloway fights this call to youth and uses his best weapon to defeat it: confidence in himself.

An expectant father always looks forward to his firstborn with anticipation. He's besieged with dreams of playing in the park or one-on-one on the basketball court. Charles Halloway had these fantasies, but instead of being pleasant, they haunted him. His age was the wall he had to gain strength to climb. He exhausted many nights at the library, where he worked as a janitor, just reading. Charles was restless in his everyday life but felt he was too old to do anything concerning it. He looked at his son Will with longing eyes, as a vision of youth flourished and grew with each day. Mr. Halloway dwelled on two fantasies. He wanted to be just young enough to delight in Will's youth along with him. Spending time with his son and getting to know him as a friend was something he felt he could never fully realize. Envy of Will's freedom wielded a principal role in Charles' attitude. It was parallel to watching an old home movie of his own childhood. Running with the wind and tackling his fears with a zest for life that could not be imprisoned or beaten was Charles Halloway's dream and this is what Will possessed that he wanted. Will was growing up, and having fun doing it, and Charles just wanted to be part of this world.

We are always searching every hollow of our surroundings in hopes of finding the solution to going back in time: to become young again but still retain our experience. The carousel offered the key. This was the ultimate goal that Charles had been yearning for most of his life. Others had been drawn to this phenomenal wonder only to become unknown: nonexistent in their present lives. By taking one free ride on a carousel playing "The Funeral March," they had lost their friends, their home, and their jobs because they were no longer the same person on the outside. Though Charles had led a rather reclusive life and had little or no self-certainty in himself, he did know that this evil was feeding off of every unsuspecting person's pain and sorrow. When he was finally able to face himself as he was, instead of wishing for something he wasn't, he gained an inner strength that helped to defeat the ominous Mr. Dark and his freaks. But these freaks were only others whom this evil had preyed upon. Charles Halloway faced his own truth and by doing so figured out that if they fed off your pain, then they would likely starve off your love.

In the song "I Heard the Bells on Christmas Day," the search for truth is explored in the line, "The wrong shall fail, the right prevail." In this case of good vs. evil, a lesson was learned in accepting who or what you are. When Charles Halloway did this, the right prevailed.

The Search for Truth

by Kim Austin

The world of music provides many avenues which are available for us, as observers, to compare the contrasting undertones of the lyrics as well as the beats of the rhythms. While happy, cheerful songs may lead us to contemplate wholesome, charitable thoughts, so do evil wicked tones imply immoral, hopeless dreams. This conflict between good and evil is evident in virtually every place you look. A good song "I Heard the Bells on Christmas Day," contrasts violently with the expressions of "The Funeral March," an example of evil. These images influence all of us and can dictate the outcomes of our lives.

The alluring aspects of evil and rebellion have been offered to us for their use in creating deception. "The Funeral March," written by Fredrick Chopin, is often used in correlation with the warning of impending doom and even death itself. Throughout the novel, *Something Wicked This Way Comes*, this slow and ominous song is repeatedly referred to by members of both the older generation, as well as the younger. It infers a slow mellowing of the psyche going forward, but when played backward (as was often done in the novel) an alive, youthful guise evolves and is seen more clearly. How ironic it is that such a song is associated with the fulfilling of dreams and restoring of hope, when in effect, it is only an insensitive and fraudulent scam induced to lure people into the trap of evil and deception. Always receiving part of their youth or beauty in exchange for eternal service to the giver of this terrific gift is their life-long drama — all because they wanted to be what they were in the past.

The month of December is traditionally a joyous time, a time for families to gather and feast, a time for church congregations to sing Christmas carols, and a time to be more giving and to serve your fellow men. A familiar carol that was sung in this novel refers to the bells that chime in the early morning sunshine – "I Heard the Bells on Christmas Day." The following lyrics of this song remind us that peace and good will should be lovingly given to all men. In the novel, a sinister character, quite the opposite of what you would expect, is seen tacking up flyers and humming the melody to this song. The author chooses this twist in the story to confuse us. When we see the strange man we are subconsciously lured into thinking that his intentions are honorable. Instead of realizing that it is strange to hear an unknown man humming Christmas carols in October, we overlook it and decide that there is nothing out of the ordinary about his nature. This is how we are seduced into doing evil things, by rationalizing the good we see even if it is the slightest possible shred of truth we find.

The ironic side to all of this is that evil can be literally right under our noses and we can't see it. Evil conceals itself until we are so drawn to it that we can't pull away and then whether we like it or not, we see what terrible consequences we've gotten ourselves into. The best way to guard against this is to always be looking for the things that might not be quite so obvious and to be careful of how you respond towards that evil.